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PART I.

### Original Contributions.

#### TWO SINGULAR CASES.

Reported, with Remarks, by J. F. STREATFEILD.

CASE I. *Congenital malposition of lenses; Iridectomies; Improvement of vision.*

In this case I first saw the patient, Louisa Durant, aged nine years, on the 29th of March, 1875. She was brought by her mother from Crayford, in Kent, and complained that she could *not see far*, and that there was a *dancing in her eyes*. Her mother had noticed her imperfect vision, and that she *screwed up her eyes*, and wished to know if she ought not to have glasses to make her see well. She could see in the distance, with either eye, only  $\frac{20}{200}$ , and read, with either eye, at a short distance,  $1\frac{1}{2}$  Snellen. She was, by the ophthalmoscopic test, myopic. She could not see with any convex, but saw better with concave glasses, best with -12: with them, however, she could only be brought up to  $\frac{20}{70}$ . The *dancing* in her eyes seemed to be explained by a frequent, almost continual, shaking or tremulousness of the *lower part only*, perhaps one-half, of

I thought would do this best (for I never now will do iridesis, by which synechiæ are artificially produced, and then, like all synechiæ, have many ill consequences likely to follow them); and moreover, I thought that by an iridectomy, extending the pupils in the direction in which the lenses were absent, I should perhaps also check the tremulousness in the corresponding parts of the irides, a part being there excised, and so obviate the annoyances of the *dancing*, which I believed to be caused by this to and fro agitation of the unsupported irides at their lower parts. The greyness of the misplaced lenses, now occupying parts of the pupillary aræ, suggested to me the iridectomy operation done for central lamellar cataract; the greyness, as I have said, was in no degree or kind a cataractous opacity, and, the lenses being transparent, the case could not be treated by their removal, as the extraction of transparent lenses is dangerous, and needle operations are not devoid of some risks. I proposed to leave the lenses and ignore their existence. She had depended on her misplaced lenses, and as she was myopic, on her concave glasses. I proposed to open out an entirely new way of vision to her, with the use of so-called cataract glasses for the future. The mother was more than willing that I should do what I thought would improve her daughter's sight, especially as in her opinion it had been getting worse of late.

I had no longer any room for doubt when, on the 7th of July, I tried the effect of strong convex glasses, the pupils at the time being fully dilated. I found she could see very much better with them now than in any other way. With  $+3\frac{1}{2}$  she could see  $\frac{2}{4}$ 0, and with  $+2\frac{1}{2}$  she read  $1\frac{1}{2}$  Snellen. When she began to read with the convex glasses the eyes seemed to be turned a little more *upwards* than before, a line perhaps.

She was admitted into University College Hospital on the 16th of July. I did iridectomy in each eye, excising symmetrically downwards a small section of the iris, not quite up to its greater circumference. In both, after the



excision, a small bead of vitreous (having less than its usual support in front) protruded through the outer wound, but, the lids being closed, these soon went back, and no escape of vitreous took place in either eye. A pad of wool over each and a bandage over both eyes were applied. All did well after the operation, but for two or three weeks there existed a small and slight cystoid protrusion of the cicatrix of the external wound of each eye. She left the hospital, and these protrusions disappeared soon after. In a few weeks she had two pairs of convex glasses,  $3\frac{1}{2}$ , with which she could (as on July 7th) see  $\frac{20}{40}$ , and also  $2\frac{1}{2}$ , with which (as before) she could read  $1\frac{1}{2}$  Snellen. With them she read comfortably, and at a good distance. No other glasses suited her better. She liked them very much. She said she could now see to thread her own needle, which she never could do before the operation. She no longer *screws up* her eyes to see to read or work. When her glasses are put on and she tries to see anything she immediately holds up her head a little more than before.

Cases of congenitally misplaced lenses are not very uncommon. The patients are generally myopic and amblyopic. The amount, and I think the direction (upwards), of the misplacement are not unfrequently such as they were in the above case. If, therefore, some of these cases of malposition may be materially benefitted by an iridectomy, it is worth noting. It is, as far as I know, the first time the operation has been done for this defect. I have since ascertained that M. de Wecker, twelve years ago, did iridesis in a case very much like the one I now report ("Annales d'Oculistique," vol. xlix, p. 159). His patient had had, before the operation, double vision in one eye. My patient did not complain of this. If, after the operation, she still saw at all (indistinctly) through her misplaced lenses, she obtained so much better images as soon as the strong convex glasses were put on, that she was not troubled by double vision at all.

CASE II. *Anomalous large, loose, floating body in the anterior chamber.*

Mr. H. R. O. Sankey, medical student, of University College, spoke to me one day, about Midsummer, 1875, at University College Hospital, about his right eye. He asked me to examine it, as it was rather uncomfortable; he had been that day long working at the microscope, and using that eye particularly, and wished to know if I observed anything wrong in it. I found nothing worth noticing, and, by any of the ordinary methods of examination, however minutely I had examined the eye, I could not have made the discovery, as he afterwards proved to me when he showed me the singular phenomenon which his eye presented. The answers to all my inquiries of him by word of mouth were negative. It may be worth specifying that he said the eye was never red or watery; he could read with either eye No. 20, Snellen, at 20 feet distance, and  $1\frac{1}{2}$  at 3 feet; and he made no complaint of any imperfection of vision in the eye to which he directed my attention.

He told me there was something in his eye which he would show me: he then held his head down, the face being in a horizontal position, for about a minute, and asked me again to look into his eye. He sat facing the window, and I soon saw a large dark body slowly descending in the anterior chamber. It was soon again out of sight in the very lowest part of the chamber, where it usually rested. He then gave me the following history. His age was 25. He first noticed a small speck in the right eye during the year 1867. At that time he supposed it to be a scale of dried ink from a pen which he had been scraping. He tried to remove it from the eye, and, as it was soon lost sight of, he supposed he had succeeded. Some months after this he saw it again (after he had been holding his head over a basin of water for awhile) in a looking-glass as before; he then saw it was not in front of the cornea, as he had before supposed, but behind it. It then appeared to be a flat oval body of dark brown colour. He thought it had then no indentation in its outline. It was rather smaller than a poppy seed. He found that it could be brought into view by inclining



the head, as it had been on this occasion. It sank more or less slowly, and was finally quite lost to view behind the lower margin of the sclerotic. It caused no inconvenience by its presence. No history of an injury to the eye could be obtained on inquiry. It was shown to several medical men, and some of them strongly recommended its removal. Since it was first seen Mr. Sankey informed me it had slightly enlarged; it was, he said, when I examined his eye, perhaps one-third or one-half larger than it was at first. It was always quite free and moveable. It was on a subsequent occasion seen to be indented on one side. This indentation sometimes presented itself on one side and at other times on the other. The eye had not troubled him, though for the last three or four years it has been the one chiefly used at microscope work for at least an hour daily.

On two subsequent occasions I made more particular inquiries and observations of this strange and unaccountable body, and of the eye itself. His irides were light bluish-grey, against which the floating body was well seen, but they were marked with darker patches, and on the inner side of the iris of the right eye was a large dark patch, and when the body was in front of this, or of the pupil, it was hardly discernible. It appeared to me, as it always appeared to him, of a brownish colour, flat and oval in shape, with an indentation on one side. Mr. Sankey had no doubt at all in his own mind that it was larger than it had been some years before, and that its shape had changed, that it was now longer and narrower in the middle as compared with what it had been when he first discovered it. He was fond of shooting, but neither in this nor in any other way had he ever had any injury of any kind, that he knew of, to the eye. Nor was any report obtained of any accident to the eye in his infancy. He thought about eight years ago he had had for a few days a slight ophthalmia of a phlyctenular character, *but this was in the left eye*, and not in the right. The first time he saw the floating body, to recognize it as such, it was only in the looking-glass that he

saw it. He never saw it on his book or writing paper or wherever it might be he was looking. He saw it afterwards not only sometimes in the looking-glass, but also when he was using Hartnack's camera (a double-prism arrangement), in drawing microscopic objects, when the head was held very much down. Then he saw it on the paper, and it appeared ill-defined, kidney-shaped, and brownish, the "hilus" not being always turned the same way; it seemed to him to turn quite freely, and he thought it turned over sometimes. When in using the camera he saw it, it occupied the whole or nearly all the field, and he could not tell which way it moved. When his vision had been thus obstructed, he then began to use the other eye instead. I inquired how long did it take, when it was opposite his pupil, if he watched it in a looking-glass, to disappear from view behind the sclerotic margin? He said he thought about three quarters of a minute, but he had known it take a minute and a half when he was not holding his head up much. We proceeded to make the following observations:—

1. He held his head horizontally down and looked on the ground till the floating body appeared to him in the centre of his pupil, then he held up his head vertically and looked straight before him, and it fell rather rapidly at first (query, till it touched the back of the cornea), then more slowly; in all it was fifty-five seconds before it had passed out of my view.

2. He then held his head horizontally down as before; the floating body took seventy-five seconds in falling forwards, before it had reached the centre of his pupillary area, and so obstructed vision in that eye.

3. The first observation being repeated, the time occupied was the same as before. The floating body in descending (and I made many more observations than these few typically noted) always took the same course, the long axis being vertical at first, and the indentation to my right hand. In descending it rotated a little, slowly and continuously, in such a manner that it reached the bottom of the anterior chamber, or rather disappeared from view behind the



sclerotic margin, with its convex side, not its end, downwards. I presume therefore that one end of the floating body was decidedly heavier than the other, and this being of course the lower end, as it slid over the incline of the back surface of the cornea it met with some slight frictional resistance, and so got a tendency to rotation; so that of the two sides the convex being of course the heavier, the body always fell with that side downwards.

4. The head having been held horizontally, and the floating body being thus by gravity brought opposite to the centre of the pupil as before, the head was suddenly brought up again and held somewhat backwards beyond the vertical position. It then fell much more rapidly and was out of sight in sixteen seconds.

5. To determine its actual size approximately, I got a large concave mirror, and in a good light collected and reflected by it into his eye and face, which was inclined downwards (but not in the horizontal position), so as to retain the floating body in view and in one place against the back of the cornea. Mr. Sankey held my small ivory French measure vertically and close beside his eye on the temporal side, at the level, as near as we could judge, of the floating body in the anterior chamber; the two being then at rest and side by side and well illuminated, he found the length of the floating body to be a millimeter, and its breadth one half.

6. With my head resting on the back of an arm-chair, and face vertically upwards, I examined the floating body with my hand microscope (Bruecke's lenses). For this purpose Mr. Sankey, standing on a footstool beside my chair, and stooping over me, brought his face vertically downwards, and at the same time threw the strong light of an ophthalmoscope mirror obliquely into his eye; so that the floating body was at rest, well illuminated, and easily examined and magnified. It was exactly kidney-shaped, perfectly regular and smooth in its curved outlines, everywhere brownish, of the colour of uvea, except in the concavity, where it was colourless or pale; of a deep brown elsewhere, especially around the

margins, deeper brown at the ends ; the direction of its long axis was the same as already mentioned for the same part of the anterior chamber, that is to say *almost* vertical. I thought it to be a flattened body, but I never could see it edgewise ; we tried many ways of getting it to turn over, but always unsuccessfully, and perhaps the not being able to get it to turn over is the best evidence we can have of its being somewhat flattened ; it was perfectly free and had no band anywhere connecting it with any of the parts of the anterior chamber.

I now used atropine to dilate the pupil of the right eye sufficiently for ophthalmoscopic examination ; in due time this being effected, and the pupil well and fully dilated, it was found not to be quite circular. On the outer (and a little towards the lower) side there was a *slight* flattening of the circumference of the pupil, and the width of the iris in that situation was *slightly* greater than elsewhere, but there was no adhesion of the iris, nor was there any evidence of a former adhesion having existed ; there was no serration of the pupil, and no uvea left on the front of the lens or on the back of the cornea. He was slightly hypermetropic ; no abnormal appearance could be seen in the fundus or in any part of the interior of the eye ; especially was there nothing abnormal in that peripheral part of the fundus seen when he looked out and a little downwards to the right (in the direction in which the slight irregularity in shape of the pupil was seen). The pupil of the left eye was not dilated with atropine, but the eye was examined, and showed no abnormal appearance with or without the ophthalmoscope.

7. In order carefully to examine the floating body, when it was at rest, with the ophthalmoscope mirror, and to determine if it were at all transparent, I now laid myself down on my back on the floor, with the ophthalmoscope lamp also on the floor a little to the right of my head, and Mr. Sankey knelt on the floor beside me, with his face horizontal, looking downwards, and in various directions. The loose body appeared, with the strong light of the ophthalmoscope



behind it, to transmit no light. Thus quietly observed with *direct* light, it appeared brown (uvea) coloured as before observed, its convex side to the left of the observer, as I had always seen it. Mr. Sankey now several times, whilst I was lying on my back and ready with the ophthalmoscope, held his head so much back as to be in the same position as mine was then, and again quickly held his face down as before for me to observe the floating body as it fell forwards. I however could never get a view of it edgeways, if it had an edge. I could never see it with the convexity or concavity towards me, I always saw both the sides described. It seemed to me to be a flat body. Once in this way of experimenting with it I saw the concavity downwards. It was never seen to change in shape whilst it was being examined by me; nor had this been observed by Mr. Sankey on any previous occasion when he had been observing it.

My advice was that at this time nothing should be done; Mr. Sankey complained of no inconvenience, he readily employed the left eye if the floating body, in using the camera, obstructed vision in the right eye. And the loose body had probably not, at least for some time, increased or changed in size or shape. But if in the future there were to arise the slightest evidence of any irritation or inflammation in the right eye-ball, or if the floating body were to grow (and we now know its dimensions), I would then recommend that it should be evacuated by an incision of the cornea, with the aqueous humour in which it so freely moved. Mr. Sankey of course would be loath to have any operation done. And the loose body has existed where it is so many years without any ill consequence arising, that one can hardly expect that any harm will come of it.

I hope it will not call for operative interference, but, at the same time, I should be very glad of an opportunity of ascertaining with certainty, after its evacuation, what is the nature of this anomalous body. And in that case I should have the pleasure of overcoming the difficulty of operating in the recumbent position, for I am sure that in no other way could the loose body be deliberately and certainly evacuated.

## TREPHINING THE SCLEROTIC—A NEW OPERATION FOR GLAUCOMA.

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Ophthalmic surgeons at the present day generally agree in viewing the symptoms present in most cases of glaucoma as dependent upon increased intra-ocular pressure. How this increase of tension is produced, whether by augmented secretion of vitreous humour, by serous transudation or inflammatory exudation into the chamber of the vitreous humour, by alteration in the structure of the sclerotic, or by other pathological states, has not yet been satisfactorily determined. It is not my object in this paper to discuss these points, although personally I incline to the view that the increased tension is due in some cases to increased secretion of vitreous humour, in others to serous transudation into the chamber of the vitreous humour. All the other symptoms of the disease, including the impairment or loss of vision, can readily be explained by the pressure to which all the structures in the interior of the eye that lie between the vitreous humour on the one hand, and the resisting sclerotic and cornea on the other, are subjected. All measures, therefore, that are undertaken for the cure of this disease, have for their object the reduction of the increased intra-ocular pressure.

The following are the operations that have hitherto been practised for the alleviation or cure of glaucoma. 1st, paracentesis of the cornea; 2nd, incisions into the chamber of the vitreous humour (known as "division of the ciliary muscle" and "intra-ocular myotomy"); and 3rd, iridectomy.

Paracentesis of the cornea is by far the simplest procedure,



and is attended with considerable benefit, but unfortunately, as was pointed out by Von Graefe, its effect is only temporary, each successive evacuation of aqueous humour producing less and less benefit, so that this method has been almost entirely abandoned.

The operation of division of the ciliary muscle, or intra-ocular myotomy, has undoubtedly a very marked effect in reducing the tension of the eye, and although the benefits arising from the operation have been attributed by the gentlemen who proposed it to a division of the ciliary muscle, I am more inclined to consider the evacuation of a small quantity of the humours of the globe and the presence of an aperture in the resisting coat of the eye as the main factors in bringing about that result. This operation never obtained very general favour, and has of late fallen much into disuse, chiefly I believe on account of the temporary character of the benefit following it, and also partly from the liability of all wounds in the ciliary region to be followed by chronic insidious cyclitis leading to loss of vision in that eye, and even by sympathetic ophthalmia in the neighbouring eye.

Thus it happens that at the present time iridectomy is the prevailing remedy for all glaucomatous affections, and should the removal of one portion of iris fail to produce the desired effect, the only further measure to be resorted to is the excision of another piece. In many cases of glaucoma iridectomy is undoubtedly followed by excellent effects, and I would be the last to decry its application in suitable cases, but it must accord with the experience of most oculists that there are occasionally cases in which the iridectomy, owing to extensive adhesions between the iris and capsule of the lens, or degenerative changes in the structure of the iris itself, cannot be effected, and others in which that operation instead of benefitting seems almost to aggravate the disease.

It is in these classes of cases particularly that some other means besides iridectomy of permanently reducing the tension of the eye, and thus allaying the severe pain that accompanies these affections, and even restoring some vision, or at any

rate retaining the vision that remains, is desiderated. This I imagine I have succeeded in obtaining by the operation of trephining the sclerotic, whereby a circular aperture about  $\frac{1}{12}$  of an inch in diameter, is drilled through that membrane, permitting the escape of some of the superabundant fluid in the chamber of the vitreous humour. This of course at once reduces the intra-ocular tension, but I further believe the reduction in tension thus produced is likely to be of a permanent character, as the circular opening in the sclerotic must be filled up by new tissue which is of less firm texture than the original sclerotic, and will thus readily yield to any pressure from within, and act the part of a safety valve should the contents of the vitreous chamber be at any future time again increased in amount.

The point I have hitherto chosen for perforating the sclerotic is at or about the junction of the ciliary processes with the choroid, so as to avoid as far as possible the more anterior parts of the ciliary processes, injury of which experience has shown is apt to produce insidious inflammatory and degenerative changes. The instrument with which I have in all cases as yet performed the operation is the corneal trephine devised by Mr. Bowman for operating on cases of conical cornea; but I found that it was not in all respects well adapted for perforating the sclerotic, and have therefore had a similar instrument made with certain modifications. I found that with Mr. Bowman's instrument it was very difficult to recognise when perforation was effected if the central brass rod was left in the cylinder, and if this central brass rod were removed before trephining, that a considerable quantity of vitreous humour was necessarily ejected through the cylinder whenever the coats were perforated, owing to the amount of pressure necessary to force the tapering cutting extremity of the cylinder through the thickness of the sclerotic. I further found that the smooth surface of the narrow cylinder did not afford the fingers a firm grasp during the necessary rotatory movements. I therefore had an instrument made by Messrs. Weiss and Son, consisting of a steel cylinder, the



cutting extremity of which for the length of  $\frac{1}{12}$  of an inch was made very thin, the other extremity of the cylinder, to the extent of fully  $\frac{1}{2}$  an inch, being surrounded by a ring of german silver roughened on its outer surface so as to afford a good hold for the fingers. The alteration in the cutting extremity is to enable perforation to be more readily effected, while the projecting shoulder prevents the instrument passing too far into the interior of the eye. When not in use there is a cap to fit over the cutting end of the cylinder to prevent it being injured. The accompanying woodcuts (drawn to the natural size) indicate the points of difference I have described.



1. Mr. Bowman's Cornea.  
Trepine, with Rod.



2. The Sclerotic Trepine,  
with Cap.

I have only performed the operation on four cases, and as each case presented certain distinctive peculiarities, I shall now give a short account of them.

CASE I. M. A. M., a short-built ill-developed looking girl 22 years of age, having the physiognomical characters of inherited syphilis, came to me for advice on the 3rd of March, 1875; she was then suffering from the results of recent

interstitial keratitis. In the *left* eye there had been corneal ulceration, for the treatment of which a saturnine lotion had been employed, whereby a dense white centrally-situated opacity (due to deposit of chloride of lead) had been produced. In the *right* eye the cornea was nebulous throughout, but also showed some more dense opaque spots, especially towards its centre. There had also been severe iritic complication in the course of the keratitis, as was indicated by extensive adhesions between the iris and capsule of lens. With the *right* eye she could count fingers at three feet, with the *left* she could only do so when the fingers were held close in front of the eye. A slight degree of injection existed in both eyes. She was ordered drops to apply to the eye, consisting of gr. ij of sulphate of atropine to ℥iij of wine of opium, and ℥v of distilled water. A drop to be applied to each eye night and morning.

She returned on June 26th, complaining especially of pain and irritation in the *left* eye, caused by a staphylomatous protrusion of the sclerotic opposite the upper margin of the cornea. The staphyloma was pretty sharply defined, was about 4 lines in diameter at its base, and projected so much as materially to interfere with the movements of the upper lid. There was a slight degree of injection of conjunctival and sub-conjunctival vessels. There was complete pupillary exclusion, and the iris bulged forwards towards the inner surface of the cornea. The tension of the eye was very much increased (T. + 3). She had still perception of light with the eye.

The *right* eye presented much the same appearance as when she first came under observation, except that the cornea had cleared at its upper and inner part, but she was still unable to see sufficiently to guide herself. The tension of this eye was normal. On June 27th, the patient having been placed under the influence of chloroform, I removed, by means of Mr. Bowman's cornea trephine, a circular disc of the sclerotic from the most protruding part of the staphyloma of the *left* eye. A small quantity of abnormally



fluid vitreous humour (or serum in the chamber of the vitreous humour) escaped through the opening. The lids were closed, and a cold compress applied.

At the same time I performed an iridectomy inwards in the *right* eye.

Very little irritation followed either operation, the *left* eye being, however, a little tender to the touch for a few days. The opening in the sclerotic became gradually cicatrised over.

Her condition on discharge, on July 10th, was as follows :

*Left eye.* The staphylomatous protrusion has completely subsided, the general curvature of the eye having become re-established. The position of the staphyloma is still evident by the blueish colour of the sclerotic at that part. The tension of the eye is slightly less than normal (T. - 1). The eye is no longer tender to the touch. The spot where the sclerotic was trephined can now scarcely be distinguished. The iris is still bulged forwards towards the cornea. There is still a very slight degree of injection of the conjunctival and the sub-conjunctival vessels, but she expresses herself free from all pain and irritation in the eye. She can now count fingers with it at one foot distance.

*Right eye.* There is now an oval-shaped pupil opposite a moderately clear portion of cornea. The tension is normal. There is no abnormal injection. She can count fingers at four feet, and see to guide herself easily. She cannot read (not knowing the letters), but readily points to and counts letters of No. XX Snellen.

The patient returned on October 4th, complaining of pain and irritation in her left eye. There was a considerable amount of sub-conjunctival injection (which became much increased when the eye was touched), and the eye was tender on pressure. The tension was diminished (T. - 1), and she could, though with difficulty, count fingers held close to the eye. The trephined spot was only visible as a minute circular grey dot, level with the adjacent sclerotic. There was no bulging of the coats of the eye anywhere, the part

that was formerly staphylomatous presenting a bluish-grey colour. As the left eye was painful and tender to the touch, and might sympathetically affect the other eye (in which the vision remained as at last report), while the patient came from a distance, and could not thus be kept under observation, I recommended enucleation, which was effected on October 6.

On examining the eye after removal, the vitreous humour was found quite clear, and of almost normal consistence, and the chief pathological change noticed in the parts posterior to the iris was an irregular arrangement of the pigment of the choroid, patches of considerable pigmentary deposit alternating with spots from which the pigment was almost absent. This was especially the case at the most anterior parts of the choroid. The trephined spot was only to be recognised by the coats of the eye being thinner at that point. There was no trace of exudation, nor any increase of the pathological condition of the choroid in the neighbourhood of that spot, while the vitreous humour lying against it was quite transparent.

CASE II. John Pearson, 59 years of age, a packer by occupation, came to the Royal Infirmary on the 25th of June last, complaining of severe pain in his left eye, attended by loss of vision.

He stated that his sight was good in both eyes till about five or six years ago, when he had an attack of inflammation in the left one, accompanied by pain in the eye and dimness of sight. The eyelids at that time were gummed together during the night, and the inflammation soon yielded to a lotion "containing zinc." He has had similar, but milder, attacks of inflammation in both eyes (probably conjunctival) at intervals since that time, but vision was not impaired during these attacks. About a month ago he noticed that his left eye was slightly inflamed and painful. He bathed it frequently with warm water, which afforded temporary relief to the pain, but the inflammation did not diminish; the pain, which was intermittent, became more constant and

more severe, and his vision became rapidly impaired, so that in three days his sight in that eye was completely lost. "He was unable with it to distinguish light from darkness."

On examination the affection of the left eye presented all the characters of acute glaucoma. Both the superficial and deeper vessels were much engorged, the pupil was somewhat dilated and immobile, there was a green reflection from the interior of the eye, the tension was greatly increased (T. + 3). There was no perception of light with that eye. The media were so turbid as to prevent ophthalmoscopic examination of the fundus. The other eye was normal.

On the following day (June 26th) I performed an iridectomy upwards. Considerable relief followed the operation, but the injection of the vessels did not diminish to any marked degree, the corneal incision showed no tendency to heal, and within a week the tension became increased to as great a degree as before, and the pain in the eye so severe at night as to prevent sleep. With the view of inducing a healing action in the wound, the edges of the incision were gently touched with a solution of nitrate of silver (gr. x.—3j) which application however occasioned great irritation, and did not effect the desired result.

The suffering endured by the patient was such as to necessitate some further remedial measure. A second iridectomy was precluded by the complete absence of the anterior chamber; it was therefore necessary either to have recourse to some other means of reducing the increased intra-ocular pressure, or to remove the eye. Having observed such a great diminution in the tension follow trephining the sclerotic in the case of M. A. M., I deemed it advisable to test the efficacy of the operation in this case rather than proceed at once to enucleation. Accordingly on July 5th I trephined the sclerotic at the distance of about two lines from the upper margin of the cornea. A considerable amount of very fluid vitreous humour escaped through the opening; a cold wet compress was applied. The pain from the operation soon subsided, and he slept well that night.



The following day the incision was found closed, and the anterior chamber filled with blood. The injection of the conjunctival and sub-conjunctival vessels was still considerable, the eye was tender to the touch, and the tension much diminished (T.—2).

July 11th. The injection has been becoming gradually less, and the blood in the anterior chamber is in process of absorption, but a little still remains. The tension is still much diminished (T.—2). The pigment of the choroid is visible at the point where the sclerotic was trephined, but the aperture is becoming cicatrised over. The lens appears to be slightly opaque, and no red reflection can be obtained on ophthalmoscopic examination. The patient has been free from pain.

On July 23rd Pearson presented himself again, and complained that severe nocturnal pain had returned. The tension was found to be increased (T.+2), and the lens had become decidedly opaque. To relieve the symptoms, on the following day the eye was punctured at the point where the sclerotic had been trephined; a considerable amount of serous fluid escaping. This gave great relief to the patient, and for a week he was free from pain; when once more the tension became increased and pain returned. This speedy recurrence of increased intraocular tension suggested to my mind the probable presence of a rapidly growing tumour in the interior of the eye, which view was strengthened by the cataractous changes in the lens and the persistence of conjunctival and sub-conjunctival injection. As the symptoms however had been so markedly alleviated for a time by paracentesis, I determined to repeat that measure once more, but recommended that should permanent benefit not follow, the eye should be enucleated. The paracentesis again effected a reduction of the tension and a relief from pain.

On August 25th, however, the pain returned (although the tension remained rather minus), and the right eye began to show symptoms of sympathetic irritation, becoming injected and watering and the sight becoming dim after use of the

eye in reading, &c., for a short time. As these symptoms did not materially abate, the left eye was enucleated on the 31st of August.

Examination of the eye. The circular trephined spot was filled up by firmly organised new fibrous tissue, which projected slightly beyond the adjacent sclerotic. The eye was cut open by a vertical incision through the centre of the cornea. On perforating the sclerotic some abnormally fluid vitreous humour escaped, and immediately a rounded tumour of light grey colour and of soft consistence came into view. This growth was found to be about the size and shape of a small bean; it was attached by one end to the extremity of the optic nerve, and to the retina, choroid and sclerotic at the outer side of the nerve (with which coats at that part it had become more or less incorporated), and bulged forwards, occupying about two-thirds of the chamber of the vitreous humour. On examining the growth microscopically, it was found to consist mainly of small oval and spindle-shaped cells, varying in diameter from about  $\frac{1}{3000}$  to  $\frac{1}{2000}$  of an inch, and having nuclei and granular contents. There was no abnormal appearance or trace of inflammation in the coats of the eye immediately adjacent to the trephined spot, which was just at the junction of the ciliary processes with the choroid. The nerve at the point where it was divided appeared healthy.

The patient made a speedy recovery from the operation, and all symptoms of sympathetic irritation rapidly subsided, and as yet there are no signs of any new growth in the orbit.

CASE III. Angus McLaren, a farm-servant, 57 years of age, came to the Royal Infirmary on the 21st of July last, complaining of severe pain in the left eye.

Rather more than a year ago he had an attack of acute inflammation of the left eye, attended with severe pain in the temple, and resulting in complete loss of vision. Since May last he has suffered periodically from severe pain in the left eye, extending to the left temporal and frontal regions, frequently preventing sleep.

Upon examination, the left eye was found to be affected with advanced glaucoma; there was injection of both conjunctival and sub-conjunctival vessels, the pupil was dilated and immovable, the iris of a slaty-grey colour, and from the interior of the eye a greenish reflection was observable. There were two or three minute staphylomatous protrusions of the sclerotic near the margin of the cornea, and the tension of the eye very much increased ( $T. + 3$ ). There was no sight in the eye. Ophthalmoscopic examination revealed deep cupping of the optic disc.

On July 22nd the sclerotic was trephined at the distance of about 2 lines from the upper and inner margin of the cornea. A small quantity of vitreous humour, of normal consistence, escaped through the opening, and some bleeding occurred under the conjunctiva. A cold wet compress was applied. The patient's sufferings were at once relieved, and he slept well that night.

The following day the tension was decidedly diminished ( $T. - 2$ ), and the eye slightly tender to the touch at the point of perforation; but the patient expressed himself much relieved.

On August 8th, the tension of the eye was found a little less than normal ( $T. - 1$ ), the vascular injection had diminished, and a little lymph was observed to protrude slightly from under the conjunctival flap covering the trephined spot. The staphylomatous protrusions had receded, the position they formerly occupied being only marked by slightly pigmented spots, and the iris presented a more healthy colour. The patient has been entirely free from pain since the operation.

On the 14th November the patient returned, by request, for examination. In the eye that had been operated on, the pupillary margin of the iris is adherent at the lower and inner side to the capsule of the lens. At the upper and outer side of the eye there is a plexus of distended tortuous sub-conjunctival veins; two especially large ones emerge from the interior at the point where the sclerotic was trephined.



The new tissue occupying the aperture in the sclerotic bulges slightly forwards, and the small pigmented spots corresponding to the staphylomata that previously existed are also very slightly raised above the level of the neighbouring sclerotic. The tension of the eye is about normal, rather diminished than increased, and there is no tenderness of the eye to touch. The pupil of the left eye contracts when light is admitted to the neighbouring one.

Vision in the right eye is normal. On directing the light with the ophthalmoscope into the left a dull grey reflection is alone obtained, which is produced by a greyish coloured membrane that appears to stretch from the point of aperture in the sclerotic across the chamber of the vitreous humour a little posterior to the lens, and prevents a view of the fundus. This membrane has a reddish tint at one point, and I think probably owes its origin to blood-extravasation. The patient states he has remained quite free from pain in the eye.

CASE IV. Jessie Pringle, aged 21, was admitted to the Ophthalmic wards of the Royal Infirmary on the 22nd September last, complaining of defective vision.

She states that she saw perfectly till about six months ago, when she noticed a mist in front of the *left* eye, accompanied by pain in the eye. The obscuration of sight lasted only about a day, but after an interval of a few days returned, and she has had recurrent attacks of impaired sight and pain in the eye and temple since. Latterly vision in this eye has not been completely restored during the intervals between the attacks. The *right* eye began to trouble her six weeks ago, exactly in the same way as the left had formerly done. Before the sight became dimmed in either eye, an appearance of coloured rings round the gas light or other bright object was noticed. She never observed any appearance of inflammation in either eye.

The patient is a dark complexioned girl, with dark brown irides, and of very diminutive stature, owing chiefly to angular curvature of the spine. In both eyes there is apparently a

slight degree of turbidity of the aqueous humour, but more marked in the left eye. The pupils are of medium size, and contract readily under the influence of light. In both eyes there are a few enlarged sub-conjunctival veins. The tension of both eyes is markedly increased (T. + 2 in the left, and nearly + 2 in the right). Vision in the left eye =  $\frac{2}{50}$ ; both convex and concave lenses impair distant vision. Vision in right eye =  $\frac{2}{50}$ ; a convex lens of 80 inches focus does not impair distant vision. In the left eye the field of vision is almost entirely absent to the inner side, and slightly contracted below. In the right eye the field of vision is about normal, perhaps slightly contracted inwards. Ophthalmoscopic examination revealed deep cupping of both optic discs, and slight pressure sufficed to produce pulsation in the retinal arteries.

On the 23rd September I performed iridectomy upwards on the right eye, and trephined the sclerotic about 2 lines from the upper and inner margin of the cornea in the left.

The patient recovered rapidly from both operations neither of which was attended with almost any irritation, and she left the hospital in a week.

On October 28th she returned to report progress. In the left eye the spot corresponding to the portion of sclerotic trephined bulges considerably forwards, and is of a blueish-black colour, with a little ring of vascularity round it. In the right eye there is scarcely any abnormal injection. The media in the left eye appeared a little dim on ophthalmoscopic examination. The optic disc was still deeply cupped, and slight pressure produced arterial pulsation.

In the right eye the media were transparent, but the cupping of the disc also deep.

The distant vision in each eye was =  $\frac{2}{70}$ , and was not improved in either eye by concave or convex lenses. Yet while with the right No. 1 (of Jaeger's types) could be read at 7 inches, only No. 12 could be read with the left.

The field of vision in both eyes was the same as previous to the operations. The tension in the left eye was less than

before the trephining, but still greater than normal ( $T. + 1$ ), while in the right it had almost returned to the healthy standard.

Her eyes were again examined on November 26th, the pupil of the left eye having been previously dilated by atropine.

*Left eye.*  $V. = \frac{1.6}{1\frac{1}{2}6}$ , but with a vertical stenopœic slit,  $V. = \frac{1.6}{64}$ . With + 12 reads No.  $4\frac{1}{2}$  with difficulty.

*Right eye.*  $V. = \frac{1.6}{64}$ , but with a vertical stenopœic slit,  $V. = \frac{1.6}{40}$ . Reads No. 2 with difficulty.

The new tissue at the trephined spot in the *left eye* still bulges freely forwards. A very fine pigmented filament was observed crossing the upper part of the dilated pupil, attached at both extremities to the anterior surface of the iris, probably remains of the pupillary membrane. The media were clear. The fundus as near the trephined spot as could be seen with the ophthalmoscope appeared normal. The optic disc was still deeply cupped. The tension still slightly above the normal ( $T. + 1$ ). The field of vision still remains almost entirely absent to the inner side, and slightly contracted below as before the operation.

In the right eye the tension is normal.

The patient was examined on December 3rd, 7th, and 21st, and on each occasion the tension in both eyes was found normal. On the last date she was tested with cylindrical lenses with the following result:—

*Left eye* with — 34 cyl.  $V. = \frac{1.6}{40}$ . Reads readily No. 6 of Jaeger, but only for a short time, fatigue and dimness of sight soon ensuing. Cylindrical lenses do not materially improve her near vision.

*Right eye* with — 16 cyl.  $V. = \frac{1.6}{25}$ . With + 16 cyl. reads No. 1 of Jaeger.

In the first two cases in which I operated, I did not bare the surface of the sclerotic before applying the trephine. In the first case this did not give rise to any inconvenience, as the conjunctiva was tightly stretched over (and perhaps adherent to) the bulging sclerotic; but in the second case I



experienced a little difficulty in applying the trephine from the ease with which the conjunctiva slid over the subjacent membrane, so that in the last two cases I turned up a flap of conjunctiva with a cataract knife before proceeding to trephine, and afterwards replaced it over the aperture. I have always made the opening through the upper part of the sclerotic, as being the part most easily got at, and as the eye during the trephining could be pressed against the firmly resisting inferior orbital plate. The lids were kept asunder by means of an ordinary spring speculum, and the eye was fixed in the usual way with toothed forceps. The only after treatment necessary was the application of cold wet compresses, frequently changed, for the first eight or ten hours, and thereafter the wearing of a shade and attention to cleanliness.

The first case subjected to the operation was one of extensive staphyloma of the sclerotic. I have previously in several instances of this disease punctured the projecting coats of the eye with considerable benefit, and this was a mode of treatment that used formerly to be frequently employed; but as a rule, the benefit is of only short duration, the coats of the eye after a short time bulging forwards as much as before. It was with the view of producing a more permanent effect that I conceived the idea of forming a circular aperture in the sclerotic which would be slow of healing. The result in this case exceeded my expectations, as in addition to the subsidence of the staphyloma, the tension, which was previously excessive, remained permanently diminished, and vision was slightly improved. Such improvement having occurred in an eye so much diseased, encouraged me to hope for still greater benefit in more favourable cases. No doubt, after the lapse of about three months, I deemed it advisable to enucleate the trephined eye, on account of some sympathetic irritation in the other; but the occurrence of this sympathetic irritation, may, I think, more reasonably be attributed to the diseased state of the eye that existed prior to the operation

than to the operation itself. This is rendered the more probable by the consideration of the comparatively healthy state of the coats of the eye around the scar of the operation.

In the second case the most marked feature was the constant recurrence of increased intra-ocular tension after the healing of the trephined opening, and after the little wounds by which paracentesis was effected had closed. This peculiar feature of the case led me to suspect an intra-ocular growth. On eventually having recourse to enucleation, the presence of a tumour was demonstrated. That, even in such a case as this, where the increased tension was due to a rapidly growing tumour, and where iridectomy had completely failed to give relief, the trephining should have been of such decided benefit, ridding the patient of pain, and diminishing tension, is irresistible proof of the efficacy of the operation.

In the third case the operation effected all that was desired; it at once relieved the pain, and caused diminished intra-ocular tension, which relief has persisted up to a recent date. I must not, however, overlook the presence of the membranous film in the vitreous humour revealed by ophthalmoscopic examination when the patient was last seen. This I think most probably resulted from extravasation of blood into the chamber of the vitreous humour after the trephining. I cannot help considering this as possibly one drawback to the performance of the operation in cases of glaucoma where there still exists a chance of recovery of vision. That some extravasation should ensue is to be looked for, when we consider that some of the blood-vessels of the choroid must be divided, and that on the sudden diminution of the intra-ocular tension, the previously compressed vessels will become distended with blood. How far this may invalidate the employment of this operation for the restoration of vision in cases of glaucoma, further experience will alone determine.

In the last case the trephining was performed on one eye, and iridectomy on the other. It was the only one of

the four in which the retention or restoration of vision could be hoped for, and I think in it a highly satisfactory result has been obtained. The eye subjected to trephining was the worst one, the vision in it considerably impaired, and gradually becoming worse, threatening to end in total blindness. After the operation we find the sight about as good as it was before, and the increased tension (in the persistence of which the danger depended) removed. I think I may fairly say that the operation was relatively as successful as the iridectomy in the other eye. One marked feature in the course of the recovery from the trephining which still remains to a certain degree, was a diminution in the power of accommodation. This may probably be explained by the injury to which some of the fibres of the ciliary muscle are subjected by the operation, and to the inflammatory exudation into the parts in the neighbourhood of the perforated spot that presumably occurs during the process of reparation.

On reviewing these cases, and summing up the result of my experience, I can as yet only say that in this operation we possess an effectual means of reducing increased intra-ocular tension. I further believe that in most cases it will be found effectual in preventing a return of increased tension, or, at any rate, in warding off the evil consequences of that condition.

In what cases it should not be employed, and in which cases it will prove most beneficial, further experience and observation will indicate. In the meantime I have deemed it right to bring this operation under the notice of the profession, so that its merits may be tested.



## AN OPERATION FOR THE RELIEF OF XEROPHTHALMIA.

By F. BULLER.

*Late Senior House-Surgeon, Royal London Ophthalmic  
Hospital.*

The treatment of xerophthalmia has hitherto been found so unsatisfactory, that when the condition becomes well pronounced probably no surgeon would venture to hold out any hopes of restoring useful vision, and even the so-called palliative remedies hardly afford sufficient relief to make it worth the patient's while to persevere in their use ; so that we find these cases steadily advancing from bad to worse, until at last the cornea frequently becomes covered by an unsightly mass of yellow incrustations, which when removed reveals this structure so altered in texture that it resembles more the surface of an ordinary fresh scar produced by the process called "healing by scabbing" than anything else, and for all visual purposes it may be said to have ceased to exist.

That, however, the most desperate case remains for a long time capable of undergoing very considerable improvement when placed under favourable circumstances, is, I think, sufficiently proved by one which I have recently had the opportunity of observing, and of which a few words may serve to give some idea.

CASE I. G. B., æt. 11, admitted *February 2, 1874*, bears unmistakable signs of hereditary syphilis, and is a puny but rather precocious lad.

Eyes became affected at 6 years of age, during an attack of measles, and have never been well since ; both conjunctival sacs almost entirely obliterated and destitute of any trace of moisture ; the lids are adherent to the eyeballs, except for about

one line in width of the lower, and a line and a half of the upper. The conjunctiva both ocular and palpebral, if such may be said to exist, is more or less rough, dry, and in parts covered with scales of epithelium. Cornea covered by thick yellowish crusts. When these were removed the cornea appeared somewhat pitted, and exuded in parts a small quantity of coloured serum. Standing in front of a window, the patient could tell when the hand was passed between it and the eyes, but could not perceive movements of the hand with his back to the light.

Under the use of a lotion containing bicarbonate of soda and glycerine, constantly applied on compresses of lint, the cornea could be kept free of dried epithelium, and vision so far improved that patient was able to count fingers at one foot distance.

After the eyelashes had been removed, the lids of the right eye detached from the globe, sewn together for ten days and then separated, some further improvement in vision was found to have taken place. The lids of the right eye were again sewn together carefully, and after they had become firmly united the patient was sent home with directions to return in twelve months, there being at the date of discharge a small aperture at the inner canthus, from which a certain quantity of moisture exuded when friction and pressure were applied to the closed lids.

Re-admitted *January 1, 1875.* The left eye in about the same condition as when last seen, the surface being covered with thickened and dry epithelium. The right lids still adherent to each other all along their borders, except for a short distance at the inner canthus, at which part a small quantity of yellowish mucus collects in the morning. Lids freely movable upon the globe, and perception of light through them good. When separated along the line of union, the cornea was found to have so far cleared that by focal illumination the iris could be seen behind an apparently normal aqueous, and with his back to the window patient could count fingers at about six feet distance. The lids were kept apart by means of oiled lint,

for several days, and the patient seemed to have no difficulty in finding his way about the ward. As soon as the edges of the lids had healed, all treatment was discontinued in order to observe the result. Unfortunately but too short a time elapsed before this became determined in an unmistakable manner; from the very day that the eye was left to itself the old enemy began to make its appearance.

The conjunctival sac, which had increased in dimensions to the extent of the separation effected between lids and globe at the previous operation, now began visibly to diminish; the moisture which pervaded it became less and less, and in proportion to the re-establishment of the xerosis, vision became more and more imperfect, and had sunk, at the date of his discharge from the Hospital, January 15th, to counting fingers at one foot, with every prospect of a speedy relapse into the same deplorable condition as obtained when first seen twelve months previously.

This case, and several other observations of a similar kind, induced me to hope that something might be done for their permanent relief by closing the lids, and then establishing a small aperture through them, opposite the centre of the cornea.

In September last a favourable case for the proposed operation was admitted, and I obtained permission to try what could be done, the result of which it is the object of this paper to relate.

CASE II. The patient, M. C., æt. 45, labourer, of Irish extraction, had suffered for many years from granular ophthalmia. At length vision becoming so defective that he could no longer gain a livelihood, he determined as a last resort to seek advice in London, and accordingly begged his way from Wales to the metropolis.

When admitted, *September 3*, in a half-starved condition, he was still able to see with the *left* eye sufficiently well to get about, but a dense pannus occupied the upper half of the cornea, nearly hiding the pupil, whilst the lower half, though traversed by blood vessels, was still tolerably clear. The conjunctival mucous membrane had lost its normal supple-

ness, was much wasted, and the retrotarsal fold almost obliterated; the inner surface of the lids was smooth, excepting here and there a few firm elevations, the remains of shrunk granulations. Notwithstanding the constant accumulation of mucus at the inner canthus, the eyeball did not appear to be properly lubricated and was evidently tending towards the condition of xerosis. This state was already considerably advanced in the *right*, where there was no longer any secretion of mucus, the moisture present seeming to consist entirely of lachrymal fluid and meibomian secretion; the fluid was not uniformly diffused, but collected on the cornea in small beady drops, like water sprinkled upon a piece of oiled paper. The conjunctiva was even more wasted than in the *left* eye, but smooth and lustreless; *puncta lachrymalia* obliterated; cornea not vascular but uniformly opaque, like ground glass. There was also entropion enough to cause many of the lashes to rub upon the corneal surface notwithstanding the limited movements of which the eyelids were capable. Vision = perception of shadows.

On *September 16th* I excised all the lashes of the *right* upper lid with as little loss of tissue as possible; pared the upper border of the lower lid without removing the eyelashes; and united the two with four fine sutures, leaving ununited only about  $\frac{1}{4}$  of an inch at the inner canthus.

The parts healed well, and nothing further was done until *October 14*, just four weeks later. I then made an incision about  $\frac{1}{3}$  of an inch long in the line of union between the lids, and another vertical cut through the skin across the middle of the first; the crucial incision thus made was as nearly as possible opposite the centre of cornea. Having dissected back the four skin flaps thus marked out, I passed the flattened end of a probe between the cornea and the lids from the aperture which had been left at the inner canthus, and with Bowman's largest corneal trephine, which is 4 mm. in diameter, cut through the remaining thickness of the lids down upon the probe. As the opening seemed rather small,



I removed another crescentic piece of tissue with the same instrument from its upper aspect, thus obtaining an oval cleanly cut aperture through the lid. To prevent such an aperture from closing, it is obviously necessary to furnish it with a mucous or cutaneous lining, and for this purpose the materials were at hand, in the shape of the four little skin flaps already mentioned. Through the point of each flap I now passed a small curved needle, armed with a fine silk thread, at the extremity of which was a small pellet of lead, serving as a knot to prevent the suture from slipping through the skin; each needle was then carried through the deep edge of the aperture in the lids upon the same side as the skin flap to which it belonged, up through the lid and the base of the flap. This arrangement enabled me, by gentle traction on the threads, to draw the four flaps of skin in towards the bottom of the wound, and retain them in place by the little pieces of lead, all of which rested in the aperture when the four sutures were tied together crosswise. As each thread emerged through the base of its flap of skin far out in the eyelid, the effect of tying them crosswise was necessarily to pucker the surrounding skin in towards the aperture in the lids, and thus undue traction upon the points of the flaps lining it was prevented.

On the following day there was some swelling of the eyelids, and discharge from the wound, so I removed all four sutures, and after cleaning the wound found the skin flaps satisfactorily united to its walls.

In a few days all swelling and redness had subsided, leaving an oval opening opposite the centre of the cornea, 5 mm. long from above downwards, and  $3\frac{1}{2}$  mm. wide; and the cornea was seen to have recovered a considerable degree of transparency, with a corresponding improvement in vision, for the patient could now count fingers at 18 inches.

It soon, however, became evident that the aperture had not been made too large, for it diminished in size from day to day, so that by the 10th of November it had contracted to 2 mm. in diameter, and was nearly circular. With

this contraction, vision, as might be expected from the incomplete transparency of the cornea, progressively improved, the patient being able, when the aperture had reached the size just indicated, to find his way about comfortably with this eye alone, and to count fingers at 10 feet distance. It had in fact become the more useful eye of the two, and the tendency on the part of the cornea to clear up to all appearance still continued. By focal illumination it was possible to see the edge of the pupil and a small portion of the iris. No further diminution in the size of the aperture in the lids had taken place between the date last-mentioned and that of his discharge from the Hospital on *November 24*, about six weeks after the establishment of the opening).

I have thought the case worth recording, first, because it has been asserted on good authority that a permanent small aperture through the eyelids cannot be established on account of the strong tendency evinced by all artificial openings in soft parts to close up whilst healing; secondly, because the operation to a certain extent restored the function of a useless organ, for there is a wide interval between the mere perception of light and the ability to count fingers at 10 feet; thirdly, the subjective sensations of the patient were vastly more comfortable after the operation, for he experienced complete relief from the feeling of pricking, burning, and dragging commonly associated with xerophthalmia.

At the same time I am inclined to think the operation is only suitable for typical cases of this kind, with firm tissues to work upon, and shrunken conjunctiva. In all other cases where it is thought advisable to close the eyelids in order to promote removal of corneal opacity, a more simple method may with advantage be adopted, viz., that of paring and uniting the edges of both lids, except for a short distance in the middle, thus leaving a narrow slit opposite the pupil.

## SUPERNUMERARY LACHRYMAL PUNCTA.

By C. E. FITZGERALD, M.D., Ch. M. (Dublin).

*Ophthalmic Surgeon to the Richmond Hospital; Surgeon to the National Eye and Ear Infirmary; Lecturer on Ophthalmic Surgery, Carmichael School of Medicine, Dublin.*

Judging from the few recorded cases of this anomaly either in anatomical or ophthalmological literature, it cannot but be regarded as of comparatively rare occurrence; and in support of this it may be mentioned that Graefe, notwithstanding his enormous field of observation, only reported one case of it.\* On the other hand Galezowski, who has devoted a good deal of attention to the affections of the lachrymal passages, says he does not believe it is so rare an anomaly as is generally supposed, and that he, for his part, has met with as many as four examples of it.† A case reported by Rau ("Cornaz. Abnormités Congén. des yeux et de leurs annexes," 1848) is quoted by Desmarres,‡ and Henle refers to two cases recorded by Foltz.§ Weber has also reported two cases,|| Zehender one,¶ and Professor Manz mentions a case in the "Handbook of Ophthalmology,"\*\* now being published in Germany. As far as I know these are the only cases on record.

During the early part of the past year I have seen

\* "Archiv. für Ophthal.," i, 1, 288.

† "Traité des Maladies des Yeux," Paris, 1872, p. 125.

‡ "Traité des Maladies des Yeux," vol. i, p. 281.

§ "Handbuch der Systematischen Anatomie." Bd. II, p. 708.

|| "Archiv. für Ophthal.," viii, 1, 352.

¶ "Klin. Monatsbl.," 1863, p. 394.

\*\* "Handbuch der gesammten Augenheilkunde," Bd. II, i, p. 113.

two examples of this anomaly, one in a patient at the National Eye and Ear Infirmary, the other in a patient attending the Eye and Ear Dispensary at the Richmond Hospital. In both cases it was the lower lid of the left eye which presented the anomaly, and in each the supernumerary punctum occupied a different position. In the first case the supplementary punctum was situated between the normal punctum and the outer margin of the lid (Fig. 1), and in the



Fig. 1.



Fig. 2.

second it was placed between the normal punctum and the inner canthus (Fig. 2), lying directly over the normal canaliculus, but not communicating with it. In both instances there was little to distinguish the supplementary from the normal puncta, excepting that the former were somewhat smaller and that they did not form the centre of any elevation resembling the normal *papilla lachrymalis*. There was in both cases a distinct and separate canal leading from each punctum into the lachrymal sac; this could be easily demonstrated by passing fine probes, one through the normal, and the other through the supplementary punctum. Moreover, by introducing the nozzle of an Anel's syringe into these supernumerary puncta it was possible to inject a stream of water into the sac and nasal canal. In both cases the distance between the supernumerary and the normal puncta was about 1.5 mm. In a communication which I have received from Professor Manz of Freiburg on the subject, he seems to regard the occurrence of the anomaly in the same light as Galezowski, namely, that it is not so rare as is generally supposed, and he believes that many cases have been overlooked or not thought worth publishing.



The position of the supplementary punctum in the first of my cases, he says, is more uncommon than in the other. In answer to the question whether there was anything in the process of development which could account for the occurrence of the anomaly, Professor Manz says we have no special information respecting the development of the *ductus lachrymalis*, "all that we know is that it is at first a short furrow in continuation of the *ductus naso-lachrymalis*, which is closed in the fourth or fifth month," the mode in which the closure takes place is still unknown.

We must trust to a further and more minute study of the embryology of the part to enlarge our knowledge on this subject, but in the meantime, Professor Manz concludes, "it is well to register all cases of congenital anomalies, with a description as detailed as possible."

## SCLEROTOMY VERSUS IRIDECTOMY.

By C. BADER,

*Ophthalmic Surgeon to Guy's Hospital.*

The object of the operation of sclerotomy is to relieve abnormal tension of the eyeball by an incision through the sclerotic, close in front of the insertion of the iris. A permanent communication between the aqueous chambers and the sub-conjunctival space adjoining the sclerotic wound is the desired result.

### CASES.

1. Mr. G., age 65, seen in consultation with Dr. Kennedy, of Bermondsey, suffered from an acute and very painful attack of inflammation in the right eye.

*Right Eye.*—Extreme chemosis, conjunctiva projecting between the eyelids; T. +, difficult to ascertain as to degree on account of chemosis. Iris in contact with cornea, pupil irregularly dilated, cornea slightly nebulous. Ophthalmoscope: dull red reflex from the interior of the eye. Bare perception of light.

*Left Eye.*—Fifteen years ago sight was lost within 24 hours by an attack of inflammation similar to the one in the right eye. Now T. + 2, cornea hazy, no iris visible; ciliary staphylomata. No perception of light.

October, 1875. Six days after the attack in the right eye, the patient was brought to my house, and both eyes were (under the anæsthetic) sclerotomised.

January, 1875. Right eye, T. —  $\frac{1}{2}$ ; slight bulging of scleral incision; pupil drawn upwards as if the eye had been iridectomised. Conjunctiva and cornea healthy; good aqueous chamber. Ophthalmoscope: optic disc whitish; vessels as thin in the disc as in the retina; no cup visible. Field of vision good, tells time on watch at 10" with convex lens.

*Left Eye.*—T. —  $\frac{1}{2}$ . Largish bulging of conjunctiva over

sclerotic incision (conjunctival staphyloma); this is no trouble to the patient, and is not seen unless the lid is considerably raised; pupil displaced upwards; portions of the iris well seen; good aqueous chamber; no pain; no perception of light.

2. Mrs. B., age 75, patient of Dr. Dickson, of Dorset Square. Right eye, sight lost suddenly 10 months ago. Left eye, not able to read, barely able to guide herself; cataract in both eyes, fully formed in the right eye.

Both eyes T. + 1 and all the other outward signs of chronic glaucoma. Ophthalmoscope: no details visible.

September, 1875. Sclerotomy of both eyes under anæsthetic.

December, 1875. Right eye T. - 1; left eye T. and elasticity normal; both eyes, cornea clear, good aqueous chamber; scar of incision in left eye a dark line, in right eye slightly staphylomatous; pupils very contracted, especially left, and cataract increasing, tells time on watch with a convex lens; field good.

3. Mrs. E., age 65, patient of Dr. Jackson, of Church Street, Spitalfields. When called to see Mrs. E. (October, 1875), I found her in bed suffering from acute glaucoma (preceded by glaucomatous symptoms for several years) of three days' standing, in the right eye; much chemosis, iris in contact with cornea, pupil irregular, dilated; T. + 2; bare perception of light. On the day of my visit the sight of the left eye began to fail rapidly; she was able to count fingers with that eye; T. + 2; pupil slightly dilated.

Both eyes were sclerotomised (under the anæsthetic).

January, 1875. Both eyes much alike; T. -  $\frac{1}{2}$ ; slight bluish bulging of line of incision; slight œdema of conjunctiva adjoining incision; pupils clear, slightly drawn up; good aqueous chambers. Ophthalmoscope: both optic discs pink, no trace of cup; vessels full in disc and retina; no displacement of vessels at margin of optic disc. Right with + 15, left + 24, reads  $2\frac{1}{2}$  of Snellen well.

4. T. G., age 24, admitted into Guy's Hospital with sloughing of both corneæ.

When I saw the patient there was in one eye T. + 1, with a large staphyloma of the entire iris.

Large sclerotomy of this eye. Three weeks later T -  $\frac{1}{2}$ ; semitransparent scar where sclerotomy had been made, staphyloma entirely gone, a flat smooth, partly black (uvea), partly brown (iris) surface occupying its place.

Two months later this same favourable condition existed.

*General remarks.*—I have performed sclerotomy for the last three years, in many cases in which iridectomy, and in some, in which excision of the eyeball, would have been practised by others.

The result has been a gradual decrease of the number of iridectomies, with a proportionate increase of sclerotomies; especially in grave cases of glaucoma, in which iridectomy would have been surrounded by great difficulties, or in which it might have been followed by loss of vitreous, etc.

*The operation.*—Most of the patients were operated upon while under the anæsthetic (alcohol, ether, and chloroform), though very unfavourable cases of glaucoma were successfully sclerotomised without an anæsthetic.

The patient is placed as for iridectomy; the eyelids are kept open with the spring speculum until the completion of the operation; the eyeball is fixed with the screw fixer near the lower margin of the cornea; the fixation is continued until the sclerotic incision is completed. For the right eye a Graefe's knife, for the left a bent cataract knife is used; thus, standing behind the patient, both eyes can be sclerotomised with the right hand.

To make the sclerotic incision the knife is thrust through conjunctiva and sclerotic into the aqueous chamber as near as possible to and in front of the insertion of the iris, is carried across the aqueous chamber without sparing the iris should it interfere with the course of the knife, and is again thrust out through the sclerotic and conjunctiva (as near as possible to and in front of the insertion of the iris). Having thus made the puncture and counterpuncture, the incision through the sclerotic is completed (in the same manner as is usual when making a corneal flap for the extraction of cataract) slowly, especially when near completion, so that the knife escapes from the sclerotic beneath the conjunctiva without any jerk. Having reached the conjunctiva, the blade is placed flat upon the outer surface of the sclerotic, the cutting edge directed backwards, and while slowly withdrawing the knife from beneath the conjunctiva some of the latter is separated from the sclerotic.

As large a bridge of conjunctiva as possible should be left, stretching across the sclerotic incision. It is beneath this con-



junctiva that the aqueous humour escapes; the iris sometimes protrudes, etc. The extent of sclerotic to be divided is equal to nearly a third of the circumference of the cornea, forming a



sclerotic flap, similar in size and shape to a small corneal flap, as used to be made for extraction of a small hard cataract.

Sclerotomy has been performed in different directions; it gives least trouble when made along the upper margin of the cornea.

When made behind the iris, or from before backwards through the ciliary muscle, it may be followed by shrinking of the eyeball.

Immediate relief of tension in the most hopeless cases of glaucoma has been the usual result of the operation.

The after treatment as to binding up, using the eyes, etc., is the same as after iridectomy.

The only troublesome sequel of the operation has been the occasional occurrence of much bulging (staphyloma) of the conjunctiva, which may become so troublesome as to require operative treatment. It should be borne in mind, that the staphyloma is not one of sclerotic, but of conjunctiva, or of conjunctiva and iris only.

P.S.—In five cases of sclerotomy, followed by large conjunctival staphyloma, or so-called hæmorrhagic glaucomatous eyes (high tension, great vascularity of tissues, much blood in vitreous chamber), a very satisfactory result was obtained by the frequent application of linseed-meal poultices. The pain, redness and staphyloma rapidly subsided: the eye, apparently doomed to excision, assumed a healthy appearance, the tension sinking below par.

CASE OF LARGE CEREBRAL TUMOUR WITHOUT OPTIC  
NEURITIS, AND WITH LEFT HEMIPLEGIA AND IMPER-  
CEPTION.

By J. HUGHLINGS JACKSON, M.D.

*Physician to the London Hospital and to the Hospital for the  
Epileptic and Paralysed.*

It would, I think, be better to say in this case (of Eliza T., see page 438), that the patient died before optic neuritis had supervened. I shall, I think, give good reasons for this statement by references to cases I have published. During the life of this patient I made the diagnosis of tumour, and therefore kept looking at her optic discs. I diagnosed tumour, and tumour of the right posterior lobe, I may here remark, from the following facts—the kind of mental defect, and from its preceeding the hemiplegia, from the hemiplegia being left sided, and because the arm suffered less than the leg.

In some cases of cerebral tumour, optic neuritis comes on late (I refer of course to cases completed by autopsy in saying this).

In a case of glioma of the hinder part of the first (uppermost) frontal lobe I discovered no optic neuritis, although, having diagnosed tumour, I carefully looked for it.\* But then this patient had only been ill about ten weeks when I last saw her. She lived close upon twelve weeks more, and thus it is not at all unlikely that optic neuritis should have come on. She had no defect of sight it is true, but that goes for nothing as evidence against the existence of optic neuritis.

\* This case is recorded in "Medical Times and Gazette," 5th June, 1875—  
"Convulsions nearly always limited to the right arm; tumour of hindermost  
part of the uppermost frontal convolution on the left side."

It would be absurd to draw such a conclusion as that a tumour in the uppermost frontal convolution did not produce optic neuritis. I might be supposed to be as likely as anyone to draw that conclusion, because I had seen another case in which when I saw the patient there was no neuritis.\* However, I think it probable that the patient in this second case (see last foot note) had had optic neuritis, for I noted, "The optic discs are probably whiter than they should be, and their margins are not sufficiently clear. The arteries (*sic*) are slightly tortuous, the veins are not." This is a poor description of changes which were trifling. But I have, since I saw that patient, seen many cases of disappearance of severe double optic neuritis—disappearance so far, I mean, that even very good ophthalmoscopists could not say there had been optic neuritis.

Now let me mention a third case of tumour in the same region, with other tumours in other positions,† all of the same cerebral hemisphere, which case also shows very late onset of neuritis, and also nearly complete disappearance of these morbid changes. This man was under my care first in December, 1873. It was only on September 19, 1874, that changes in his optic nerves were seen. His discs had been examined scores of times before, the diagnosis of tumour having been made months previously. Now I saw this man in August, a month before the onset of the neuritis, in a condition which I thought would probably soon end fatally; had it done so, the record would have been of a case of tumour of the brain

\* Recorded, "Medical Mirror," 1st Sept., 1869, and also "Medical Times and Gazette," 24th Oct., 1874—"Convulsion, limited to the right arm, followed by paralysis of that arm; tumour of the hinder part of the uppermost frontal convolution; tumour of both lobes of the cerebellum; no symptom referable to the cerebellum."

† Case recorded in "Medical Times and Gazette," 19th June, 1875—"Right-sided fits, most of them limited to the right arm; subsequently hemiplegia; double optic neuritis; tumours of the left cerebral hemisphere. The examination of the brain was made by Dr. Gowers." In the "Medical Times and Gazette," 21st July, is a wood-cut from a drawing of the brain by Dr. Gowers, showing the tumours appearing on the surface; there was one below the surface in the hindermost part of the uppermost frontal convolution.

which had not produced neuritis. As the actual progress of the case showed, the statement, "which had not *yet* produced neuritis," would have been better, for, as I have said, it did come on late. In about six weeks after the onset of the neuritis the discs were again normal. Had I examined for the first time the discs only shortly before death, which occurred in December, 1874, I might have supposed too that the tumour had not produced optic neuritis. It is a very common thing for the changes of severe optic neuritis to pass off, so far at least as to leave only slight changes recognisable by careful direct examination, and such slight changes which we should not (without of course *knowing* that there *had* *been* optic neuritis) dare to call relics of neuritis.

Let me now mention a still more striking case of late onset of neuritis. The man had had symptoms of brain\* disease (convulsions) for about nine years before his death.

As from first to last his motor symptoms were all local, the probability is that the patient had had cerebral tumour nine years; he was under my care three years. He died March 29, 1875, and yet it was only about the middle of February of that year that the neuritis was discovered. His discs had been previously examined scores of times. It may, however, be well to give direct evidence as to the state of his eyes so late in his case as December, 1874. At this time he had some difficulty in reading. I could not determine whether this was part of his aphasia (for his articulation was at that time ataxic), or owing to defect of sight; his optic discs were normal. Mr. Couper was so good as to examine the patient for me. He too considered the discs normal, but he discovered (by the ophthalmoscope) a high degree of hypermetropia. When, on Mr. Couper's suggestion, we used a  $\frac{1}{7}$  convex, the patient read very much better, but there was a residuum of aphasic difficulty. When the optic neuritis came on, no difference

\* Case recorded in "Medical Times and Gazette," 4th Sept., 1875—"Convulsions mostly beginning in the right leg; several years later right hemiplegia and aphasia; late onset of double optic neuritis; autopsy; tumour of the left cerebral hemisphere." (The examination of the brain in this case also was made for me by Dr. Gowers.)



was noticed in the patient's manner as regards sight, but we could not, at that stage of his illness, test it properly.

Here again we see the importance of knowing that there may be no defect of sight with optic neuritis. In the cases of the two men last noted above, there was no particle of evidence to indicate neuritis, except that supplied by the ophthalmoscope. Without the ophthalmoscope the defect of sight in one case, really the result of hypermetropia, might have been erroneously attributed to something wrong with the optic nerves. Again in this case it was simply impracticable to determine the hypermetropia without using the ophthalmoscope.

The mode of onset in the following case is noteworthy. The first symptoms were those of what I call Imperception. She often did not know objects, persons, and places. To the statement that there was only "confusion of mind," I do not object, for I should say that her mental confusion showed itself in inability to recognise objects, persons, and places. Nor do I object to its being called "only loss or defect of memory;" it was a loss or defect of memory for persons, objects, and places. Nor do I mind it being said that there was "only imbecility;" imbecility, like confusion of thought and defect of memory, is nearly always a matter of defect in perceiving things (persons, objects, and places).

There was what I would call "Imperception," a defect as special as Aphasia. The case did not correspond however to *loss* of speech, but to defect of speech. Total imbecility would correspond to loss of speech. There was partial Imperception.

I may add to the above that I am well aware that the character of the mental defect this woman had is that of delirium in acute disease, and also therefore that it is a defect of a common kind. These admissions leave the statement that she had Imperception untouched.

I think, as Bastian does, that the posterior lobes are the seat of the most intellectual processes. This is in effect saying that they are the seat of visual ideation, for most of

our mental operations are carried on in visual ideas. I think too that the right posterior lobe is the "leading" side, the left the more automatic. This is analogous to the difference I make as regards use of words, the right is the automatic side for words, and the left the side for that use of words which is speech. I confess, however, that I have little direct evidence as to the localisation of the morbid changes causing Imperception.

*SUMMARY OF CASE.—Imperception followed by left Hemiplegia, in which the upper arm suffered more than the lower arm, and the leg more than the arm—No Optic Neuritis; only trifling changes in the Optic Discs—Autopsy: large Glioma of the right posterior lobe.*

(For the Notes of the Case I am indebted to Mr. Charles Mercier.)

Eliza T., æt. 59, was admitted under Dr. Down's care, March 2, 1875. The following account was derived from the patient's daughter, an intelligent woman.

Patient has been a healthy woman up to the time of her present illness. Has never had rheumatic fever. For two months before this illness set in she had pain in the head and "neuralgia," but never did anything odd until about Christmas time. She was going from her own house to Victoria Park, a short distance and over roads that she knows quite well, as she has lived in the same house for 30 years, and has had frequent occasion to go to the park; on this occasion, however, she could not find her way there, and after making several mistakes she had to ask her way, although the park gates were just in front of her. When she wished to return she was utterly unable to find her way, and had to be taken home by a country relation to whom she was showing the Park for the first time. When she got home she seemed as usual, but from this time she began to alter, and during the next three or four weeks she seemed to age rapidly, got weaker and more feeble. Now and then too she would do odd things, she would put sugar in the tea two or three times over, she made mistakes in dressing herself; put her things on wrong side before, and did little things of that kind.

Five weeks ago she complained of feeling sick, and vomited ; the next day she seemed dull, and less cheerful than usual ; on the third day she astonished her friends by keeping her eyes shut the whole day ; she sat by the fire with her eyes shut and never moved ; yet she spoke and answered sensibly when questioned. She did make mistakes, but was never bad enough to make her friends think she was losing her wits. When she went to bed she was in the same condition. In the middle of the night her husband spoke to her, and found that she did not answer him, and the next morning when my informant saw her, she was lying quite senseless, making a kind of snoring noise. Her eyes were closed, she did not know anybody, and did not say anything, not even yes or no. She lay thus two days, and then became light-headed, talked a great deal of nonsense, and what she said she could not say distinctly except short in sentences. It was now noticed that her left arm and leg were paralysed ; she could not move either of them in the least. From that time she has been gradually getting more herself. As she recovered she showed that her mind was still defective ; she could not remember events from one hour to another. She mistook the people about her. When she came into the Hospital, she called all the nurses " Annie " (her daughter's name). She would say to one nurse " Are you the one that came just now ? " when she had been previously visited by another nurse. She asked the under nurse how she was to know her from that one who had long tails, *i.e.*, strings to her cap.

March 9. She names a penny and a shilling, but slowly. A new penny she says is a sovereign, then that it is a two-shilling piece, only gold, then a new penny or a new half-penny, a florin and a shilling. " Are you sure ? " " Well, I think so " (a long pause.) " If it's not a shilling, it's a two-shilling piece."

After considering for some time, she names a watch. " What is the time ? " (seven minutes past three) " A quarter past three, twenty minutes past three, ten minutes past three." When asked to read " Beef tea " in three-quarter inch letters, she spelt out " JOAD " for the Beef, and " E L I Z A " for the tea. (Her maiden name was Eliza Joad).

When told to read Snellen's test types, she did not know how to set about it, began at the right lower corner and tried to read backwards ; when asked if it was because she could not see, she

said, "No, she didn't think it was, she didn't seem to know how."

When set to read 12 Snellen, she read, pointing to the letters, "'The name colony' and 'name' again." Having got to the end of the line, she did not know where to go, and after hovering about at last she pointed to *the* and said, "that's 'the,' and to me they look all 'the's, the's, the's.'" I asked her "Is this word (took) book?" She replied "B double O K, book."

She names the colours of letters correctly, though she mistakes the letters themselves. Names a cap and other familiar objects.

She states correctly various facts about her native town, which town the reporter knows well, the directions of the roads and the towns to which they lead. She is not always correct, and she thinks a long while before answering, and seems very much puzzled.

In describing the way from her own house to Victoria Park, she speaks of going at the back of the barracks. This is so.

March 13. She is elderly and degenerate; thin, wrinkled skin, ectasia of vessels on cheeks, grey hair, barrel-shaped chest, teeth few and worn, no or very little arcus senilis. She has physical signs of emphysema, and her heart sounds are feeble, diffused, and tic-tac, but there is no other evidence of thoracic disease. Pulse 100, fair volume, regular.

Temperature ranges between 99° and 100°. Urine s. g. 1030, neutral, yellow, clear, no albumen. Appetite fair. Bowels open. Sleeps fairly. She had two bedsores.

The upper part of the face is symmetrical as regards motion, but the left upper lip droops to a trifling extent. Tongue in middle line, symmetrical. Ocular movements good in all directions. The left arm has impaired power, which is worst above and diminishes downwards. She does not move the arm from the shoulder in the least. The elbow she moves to a trifling extent in flexion and extension. Pronation and supination are pretty good. Movement of the fingers, though uncertain, is pretty free, most so at the metacarpo-phalangeal joint, the other movements being somewhat stiff. Movement of the thumb considerable, but that member is kept close to the index. Thus the loss of power is very much less comparatively in the hand than the arm.

The left leg, too, suffers much more in comparison than the



arm. She can only just draw it up and push it down in the bed. Cannot raise it from the bed. Movements of the toes, however, are pretty free.

There is no discoverable anæsthesia on the left side. There are occasional tremblings of the left fingers and hand.

No head-ache or vomiting. Her discs are slightly ill-defined, streaked, not swollen; at the upper part of the right are several very minute hæmorrhages. The changes altogether were very slight. The eyes were often examined.

She does not pass motions or water under her, but always calls for the bed-pan.

On trying her very carefully on March 20 for hemiopia, no results were obtained, for it was impossible to make her keep her eye fixed on the central point. The only noticeable thing was that she sometimes kept her eye on the central point when asked if she could see an object on her right, but *invariably* looked at one placed on her left.

After being in the Hospital about a fortnight, her mental conditions improved very much. Indeed one day Dr. Hughlings Jackson took a medical friend to see her and could demonstrate no mental imperfection of consequence.

March 21. She looks as if asleep, but it is found impossible to rouse her. Her pulse is rather rapid and small, her face is unaltered, and she has just taken hold of her left hand with her right. From this she gradually faded out, passing from sleep into coma, and from coma into death. She died the same evening (21st). At 10 p.m. Mr. Smith made a note. "Patient lying on her back insensible, cannot be roused. Conjunctiva insensible. Respiration slow, tracheal rales. Pupils equal and contracted."

Autopsy—March 23. Permission was given to open the head only. On removing the calvaria the dura mater was found to be tightly stretched. When it was slit up, the convolutions were found to be tightly pressed against it, very much flattened, the sulci wholly obliterated, and a few of the larger veins only were visible on the surface. The brain substance looked strikingly anæmic, a dull greyish-white, with scarcely the slightest shade of pink. On lifting the brain from the base of the skull, a portion was found strongly adherent to the right petrous bone or dura mater, and when the encephalon was wholly removed, this proved to be the surface of a tumour which here emerged from the interior.

*Examination of the Brain, by Dr. Gowers.*

SUMMARY—*A large Gliomatous Tumour in hinder part of Right Temporo-Sphenoidal Lobe: other smaller growths near and in Right Hippocampus Major.*

The largest mass lay beneath the posterior cornu of the right lateral ventricle, in the floor of which it caused a prominence, almost filling up the cornu. The commencement of the descending cornu was one inch further from the posterior extremity of the hemisphere than on the opposite side. In the floor of the descending cornu was a rounded projection, the size of a walnut, in contact with the hippocampus major but not continuous with it. On the under and inner aspect of the hemisphere the tumour had broken through, forming a soft projection 2 in. by 1 in., the anterior extremity of which was close to, but did not involve, the termination of the gyrus fornicatus (in the uncinate convolution) in front of the extremity of the parieto-occipital fissure. Thence it extended downwards and backwards. A transverse section through the hemisphere, just in front of the junction of the calcarine and parieto-occipital fissures, showed the tumour to involve the whole area beneath the posterior cornu and calcarine fissure, as far as the grey matter of the surface on both the outer and inner sides; while below, it came through the convolutions as already described. The section of the tumour measured  $1\frac{1}{2}$  inch from above down, 2 inches from side to side. Behind this spot it rapidly lessened in size, extending along the inner side, so that in a section across the hemisphere at the extremity of the posterior it was only half an inch in each diameter, and occupied the inner half of the section, beneath the calcarine fissure. It ceased immediately behind this spot.

The section of this tumour was greyish-red, soft, in places somewhat spongy in appearance, very vascular, mottled with

red lines and conspicuous vessels. In many places, and everywhere in the posterior portion, it passed insensibly into the brain tissue, but at some places was bounded by a narrow translucent line. The prominence in the descending cornu was covered on the surface by a thin layer of nervous substance, beneath which was new growth and much extravasated blood, as if hæmorrhage had taken place into the tumour.

On the inner surface of the temporo-sphenoidal lobe a second smaller outgrowth of tumour existed in front of the other, less prominent, involving the middle and inferior occipito-temporal convolutions in an area of about a square inch. It was separated from the other mass by about half an inch of healthy convolution. On section this was found to be part of a second growth, about the size of a walnut, lying beneath and in the lower extremity of the hippocampus major. Although very near the other, the two were not continuous. The lower extremity of the hippocampus was much larger than that of the opposite side, forming a swelling one inch long and three quarters of an inch across, while that of the opposite side was only half an inch across. The surface was normal in appearance. On section it was infiltrated with new growth, moderately firm, and uniformly reddish-grey in aspect. Neither with the naked eye or the microscope could any of the normal structure of the hippocampus be distinguished, except the layer of fibres on the outer surface and the curved layer of fibres which courses across it from its junction with the outer side of the ventricle (and are some of the prolonged fibres of the tapelum). These appeared to the naked eye to divide the otherwise uniform mass into two portions, but under the microscope the new growth was continuous from one part to the other.

Anterior to this second growth was another still smaller nodule in the white substance of the temporo-sphenoidal lobe, about a third of an inch in diameter, pink in tint, and passing gradually into the adjacent cerebral substance.

The structure of the tumours approached most nearly to

that of a glioma. They were composed of small round nuclei, apparently free, and of  $\frac{1}{3000}$  inch diameter average size ; of larger rounded and angular cells, and of nucleated fusiform cells with delicate prolongations. In some parts the fusiform cells formed the chief part of the growth, but in others the nuclei and small round cells were scattered in the meshes of a delicate fibrillar tissue. At the edge at which the smallest growth was extending, on passing from the healthy tissue to the new growth, the minute nuclei of the grey matter of the convolution became more numerous, more densely aggregated, until they constituted a compact mass, in which a few larger cells were scattered. The vessels were everywhere numerous and distended with blood.

The corpus striatum and optic thalamus were unaffected ; no abnormality could be found elsewhere in the brain.



A CASE OF DOUBLE OPTIC NEURITIS WITHOUT  
CEREBRAL TUMOUR.

By J. HUGHLINGS JACKSON, M.D., F.R.C.P.

In the case I have to relate there was well marked double optic neuritis with blindness. At the autopsy no morbid intra-cranial changes were seen except those of very great congestion of the brain, and these were doubtless recent. In this regard the case is exceptional. In most cases of double optic neuritis there is tumour, or some kind of "coarse"\* disease. In the case I am about to relate there were (see Dr. Sutton's examination, p. 452) minute morbid changes; but still the case is very exceptional.

It must be remarked too, that although I speak chiefly of the optic neuritis, *the whole tenor of the case was that of a case of intra-cranial tumour.*

It would, I believe, have been considered a case of cerebral tumour by physicians who do not value ophthalmoscopic evidence.

I have now seen several cases of double optic neuritis in cases without cerebral tumour.

Nevertheless I think that optic neuritis *is the most valuable of all signs of coarse organic disease within the cranium*; but it is not decisive evidence. The following quotation from a "Lecture on Optic Neuritis," published in

\* The expression "coarse disease" is used as a general term to include new growths (gliomata, syphilomata, &c.) cysts, abscess, and in fact all kinds of adventitious product, or to use a common word, all sorts of lumps within the cranium. These are all "foreign bodies," and each of them may lead to changes in the optic nerves.

I think too that there is but *one* kind of change produced by intra-cranial growths; I call this optic neuritis. I do not make the distinction into optic neuritis and "staalungs papilla" ("choked disc" of Allbutt.)

1871, embodies the opinions I still hold on the diagnostic value of neuritis. I begin by speaking of the limitation of my experience of optic neuritis.\*

"I have spoken above of a Physician's experience, and I hasten to qualify my remarks. I see those patients who have *severe cerebral disease*. No one ever consults me for defect of sight only, but for such symptoms as severe headache, convulsion, and hemiplegia, with which optic neuritis often occurs. To me defect of sight is but one symptom, and not the most important one, in a series. I admit, then, that my experience is of necessity one-sided. Further, I admit that in a few cases of severe cerebral disease where I have discovered double optic neuritis, I have found no kind of coarse disease *post-mortem*.

"I have been wrong several times in the diagnosis of an adventitious product within the skull in cases where there had been found double optic neuritis, *but I have far oftener been wrong by neglecting the inferences above stated to be deducible from the presence or absence of optic neuritis*—wrong in saying there *was* an adventitious product when the discs were normal, and wrong in saying there *was not* when there was double optic neuritis. I feel, therefore, justified in saying that double optic neuritis does point *very strongly indeed* to coarse disease inside the head.

"You will not misunderstand me to imply that you are to diagnose tumour or other coarse disease of the brain solely by the ophthalmoscope. You have, in most cases, *no need* to rely on this one condition. You do not diagnose phthisis by the physical signs alone. You may say that you would be right *in most cases* if you did trust to physical signs alone. I may go so far as to the ophthalmoscopical signs. You would be right *in most cases*, I believe, if you diagnosed coarse disease within the skull by the presence of optic neuritis."

\* This and the five subsequent paragraphs have already been published in a pamphlet printed for private circulation. They appeared in this way before the case related in the text was seen by me.

In some cases we find with optic neuritis (I now speak of cases in which *post-mortem* examination reveals intra-cranial tumour) changes in the retina very like, sometimes quite like, those occurring with chronic Bright's disease. On the other hand, in some cases of Bright's disease the disc is swollen to a degree equalling that found in some cases of intra-cranial tumour, and there are lustreless and shapeless white spots about the disc, and also blotches; not only streaks of blood like those which are seen in very many cases of neuritis from intra-cranial tumour. Dr. Herm. Schmidt and Dr. Wegner ("Archiv. f. Oph.," Bd. xv, Abth. iii, s. 253—275) report a case of cerebral tumour in which the ophthalmoscopic signs were quite like those in a case of kidney disease. (See Dr. Noyes' report on "Ophthalmology," "New York Medical Journal," February, 1871, p. 210.)

Hutchinson ("Royal London Ophthalmic Hospital Reports," vol. v, p. 308) in some cases of optic atrophy in children, no doubt the sequel of neuritis, has seen at the yellow-spot region groups of highly refractive globules, resembling at first glance clusters of spider's eggs.

The following is an extract from Mr. Brudenel Carter's recently published work. I fear I blundered in not having examined the patient's urine in the case of renal disease to which he refers.

"Many attempts have been made by various writers to distinguish 'neuritis optici' from 'perineuritis,' and both from mechanical obstruction; but I have never been able to satisfy myself of the validity of the distinctions which have been drawn. Dr. Hughlings Jackson, who has investigated the subject with infinite pains and care, and who has followed a large number of his cases to the *post-mortem* table, will not say more than that 'optic neuritis,' his general expression for the changes under consideration, is an evidence of some coarse intra-cranial lesion, and I myself can only say that it is frequently associated with such lesion.

"We had a little boy in St. George's Hospital in 1872,

who was transferred from my care to that of Dr. Fuller, and who had choked discs of the most typical character. Dr. Hughlings Jackson saw him, and entertained no doubt that he was the subject of some form of brain disease: and the same opinion was expressed by Dr. Noyes, of New York, and by several members of the International Ophthalmological Congress, which was then assembled in London. The boy died of pleurisy supervening upon advanced kidney disease, and no trace of mischief in his brain could be discovered by the most careful examination.

“Nearly at the same time we had in the Hospital a young woman whose eyes presented typical examples of the changes often associated with albuminuria, but who died with healthy kidneys, of a tumour in the cerebellum.”

One peculiarity in the case I am about to relate is the absolute amaurosis. This is a rare thing in physicians' practice. I rarely see such discs as this patient had, with loss, or even with extreme defect, of sight. On the other hand I very often see optic neuritis without impairment of vision. The patient was sent to me by Mr. James Adams, it was then essentially an ophthalmic surgeon's case.

I would say, too, that during the woman's life I had no doubt that we should find an intra-cranial tumour (or other kind of coarse disease). I ought to have been less confident, because I once before felt certain that I should find an intra-cranial tumour in a case of double optic neuritis, and found only general cerebral atrophy; there was no adventitious product, nor any trace nor relics of it. I did not examine any of the brain of that patient microscopically.

In the case about to be narrated we cannot invoke raised intra-cranial pressure as a cause, for there was no evidence of it; the congestion of the brain was certainly no evidence of it; it was simply owing to the mode of death. I cannot do better here than quote what Wilks and Moxon say of cerebral congestion.

“There is no doubt that congestion of the brain is the cause of serious symptoms, and even of death. We particularly ask



you not to suppose that we are denying the existence of congestion of the brain as a fatal disease, what we wish to say is, that a fulness of the vessels after death cannot *prove* the occurrence of the primary congestion, and in fact *post mortem fulness of the vessels of the brain and its membranes is of no pathological value whatever* (italics in original) as showing brain disease, because asphyxia produces it. On the other hand anæmia of the brain does exclude congestion, and also proves that death was not through asphyxia, which always produces congestion. Our reason for saying all this so confidently, when even now you find writers in systems of medicine speaking of redness of the cerebral membranes as the great sign of inflammation, &c., is that we have seen all degrees of intensity of such congestion when there was no trace of cerebral disturbance during the life of the individual, and this we have seen, not occasionally, but as a common occurrence. Again, it is not only the experience of morbid anatomists which declares intra-cranial congestion to be thus valueless, we will quote for you a passage from Kussmaul and Tenner's account of their elaborate researches on the effects of hæmorrhage as causing epilepsy. They say, 'We could never deduce any results from the *post mortem* examinations undertaken with a view to determine the state of fulness before death of the most important parts of the vascular system, viz., of the arteries and arterial capillaries, and even in the most favourable instance, when similar inquiries were directed towards the veins, our results could only be looked upon as approximate.'

"Thus you will see that it is only for lack of information that any one would speak of congestion of the brain as a proof of a cause of death. You may *infer* reasonably from the circumstances of particular cases that death occurred from congestion of the brain, but you cannot *prove* it after death by inspection. We shall presently endeavour to show you in what degree certain appearances of the brain are evidences of congestion." ("Pathological Anatomy," Wilks and Moxon, pp. 202-3.)

SUMMARY OF CASE.—*Headaches nearly all life—Attack of Vertigo with Unconsciousness—Intense Headache, Vomiting and Double Optic Neuritis—No Paralytic Symptoms—Death in Asphyxia—Autopsy—No “Coarse” Disease—Extreme Cerebral Congestion.*

(Abstract of Notes by Mr. Charles Mercier.)

Henrietta S., æt. 34, admitted December 19, 1874, married. Her family history presented nothing of importance.

Ever since she could remember she had suffered with pain in her head, which she described as of two kinds—headache, and peculiar pain, darting like neuralgia or “rheumatics.” The former occurred generally about once a-week, the latter usually after her menstrual periods. No history of syphilis.

Three years before admission her husband came home from a long absence at sea, and three months later she had a miscarriage. From this time her menstrual flow became exceedingly irregular, coming on at the slightest provocation at any time, and lasting for weeks together. A year and three quarters later she had another miscarriage, and a year before admission her head began to be very bad. The first occurrence of her illness was an attack of severe vertigo, with momentary unconsciousness, followed by severe headache which lasted for four days. At the end of this time she had another attack, after which the headache lasted for three weeks, with occasional remissions, during which she vomited. The vomiting was usually followed by a feeling “as if she were going down into a pit,” and by hot sweats.

At this time also she used to have “dark shadows coming over her eyes, and popping noises all about her head, and such dreadful whistling and howling in her ears.”

After three months the condition of her sight was as follows. Sometimes she had an appearance of darkness, and at such times, although her sight was very deficient, she could, although with difficulty, recognise people’s faces. At other times she had an appearance of light, with heavy shadows waving in front of her, and although, from the sensation being one of light, she thought that her sight was better at these times, it is probable that vision was quite absent, for she used to run against objects. At length, three months before admission, she rather suddenly had an impression of brilliant light which remained permanent, and since that hour she was completely blind.

On admission, she was a well nourished woman, of exceedingly dark complexion; very intelligent, giving her answers with unusual precision and directness for a hospital patient, and she showed great dexterity in making up for her loss of sight by employing her ears, &c. She was by no means an emotional woman, was very patient under her suffering, which was evidently great, explained and described naturally the subjective sensations which affected her without any exaggeration of expression or gesture. Her organs and functions were all in good order, her vital condition good. Pulse regular, but very small, hard and singularly incompressible. There was no local paralysis whatever, no defect of voice, articulation or speech. She suffered occasionally from attacks of most severe pain in the head, frequently accompanied by vomiting. There was extreme double optic neuritis. Mr. Couper (January 3) reported, "The condition approaches the choked disc, there is very great swelling and extreme tortuosity of the veins. The distance between the apex and the base of the disc is represented by a  $+\frac{1}{8}$  glass." This referred to only one eye, the other was similar.

On January 6 a very severe attack of pain began. She described it as being at the vertex, and "like anything splitting my head right in two." An injection of morphia gave great relief for three or four hours. At the end of that time she had ten leaches applied, five behind each ear. After this the pain became rapidly more severe.

Temperature  $99.4^{\circ}$ — $98.4^{\circ}$ . Pulse 102—96. Respiration 20—24. For the next four days she suffered the most extreme pain in her head, which made her toss from side to side holding her head in her hands and crying, "Oh, my head! I don't know what I shall do." From time to time she gained relief and even sleep from morphia and chloral. She retched and vomited very frequently. Her temperature varied between  $98.4^{\circ}$  and  $99.4^{\circ}$ .

On January 10 her head was actually steaming, vapour rising from it visibly. She had had no application to it. From this time she gradually sank, first into what appeared to be natural sleep, then into heavy sleep, and finally on January 12, into coma, in which she died. The immediate cause of death appeared to be failure of respiration. Her breathing became extremely laboured, her face excessively livid, her hands and

arms also blue and her whole body was bathed in sweat. Pulse excessively weak, 202. Heart's action loud and tumultuous.

*Autopsy by Dr. Sutton.*—A well developed body. No œdema; fairly nourished. Scalp normal. Very little diploe of skull, bone mostly compact. Dura mater healthy. Sinuses full of blackish blood; even the veins in the bone seemingly distended, and giving the bone over the longitudinal sinuses a deep red appearance. Arachnoid healthy. Pia mater vessels enormously distended and of a blackish colour. It is rare to see the vessels of the pia mater so very much engorged. This was the case mostly over the posterior half of the brain. No wasting of convolutions, nor were they unduly flattened, as is usual in abnormal intra-cranial pressure. On section no disease was appreciable in the brain. Its substance was moderately firm. The grey matter had a pinkish-red, unduly vascular appearance. The central ganglia seemed normal. The pons, medulla, cerebellum, and spinal cord had also in their grey matter the same unduly red hyperæmic appearance. They were firm throughout. No appreciable change in membranes. The optic discs looked swelled, prominent, and their edges lost.

Pleuræ normal. One lung was œdematous. No other change in it. The other was very crepitant, and of a bright red colour. When squeezed only a little blood escaped. On the whole the lungs contained comparatively little blood.

Pericardium normal. Heart normal; left ventricle very firmly contracted, almost empty; right auricle distended with blood.

The other organs were normal, venously congestion only.

The following account of the microscopical appearances of the brain also is by Dr. Sutton.

On examining a section of a convolution of the anterior lobe of the cerebral hemisphere, and contrasting it with a section of healthy brain-convolutions about the corresponding part, it is clear that there is morbid change. It is first noticed that the spherical nuclear bodies in this woman's brain are much more numerous than in the healthy one, whilst the pyramidal cells are very much less numerous. Here and there well formed pyramidal cells are seen with their lateral processes; and immediately adjoining them, where other pyramidal cells



are usually found in a somewhat regular orderly manner, are a large number of well-stained nuclei, about the size of white blood cells, with pale unstained parts (apparently cell-bodies) around them. This paler material is bounded by an ill-defined but unmistakable border. In the border, in some parts, a stellate or spindle shaped nucleus is seen. Although these nuclear bodies have mostly the size just named, some are larger and others much smaller. By the side of some of the larger ones, smaller ones are seen, one or two; as if a larger one had divided, and the smaller were off-shoots. This is a very noticeable feature in many places, and those nuclear bodies seem collected in groups in parts; in other words, they are much more numerous in some parts than in others.

Where more numerous there is very little of the paler substance around them, and around some it is not at all appreciable, the nuclear bodies lying so close as to touch or almost touch each other. Ten or twenty of these may be thus aggregated. These bodies seem to lie mostly in the second and third layers of the convolutions; that is dividing the grey matter of the convolutions into five layers, as is done by Meynezt and others.

The neuroglia as contrasted with that of healthy brain, the sections being about equally thin, is observed to be much more granular; the fibre arrangement is much less distinct, it has a more uniform, granular aspect. The capillaries are for the most part full of red corpuscles. The capillary walls look normal, the perivascular space being very distinct; in parts seemingly wider than normal. There is no appreciable thickening around the larger vessels, and for the most part there is no nuclear growth along the borders of the perivascular spaces, only here and there. There is no decided collections of leucocytes around the capillaries to indicate very active and recent exudation. Here and there, however, two or three round bodies like white blood cells are seen lying on the capillary wall. It is further observed that in some places the neuroglia seems to be disorganised; there are irregularly shaped spaces in which the neuroglia seems to be broken down, whether artificial or otherwise.

*Examination of the Backs of the Eyes, by Dr. Gowers.*

The backs of the eyes examined after preservation in Müller's fluid.

*Eye 1.*—The optic nerve entrance is the seat of a swelling of moderate prominence, which extends on each side beyond the edge of the disc, and then gradually subsides to the retinal level. The subsidence is so gradual that it is difficult to measure its diameter; it probably is about the  $\frac{1}{10}$ th of an inch. There is a central depression with rather steep sides, the bottom of the depression being  $\frac{1}{50}$ th of an inch below the highest portion of the swelling. The greatest thickness of the latter is opposite the edge of the choroid, and there amounts to  $\frac{1}{25}$ th of an inch.

The central vein and artery are both large, the vein especially; they show no trace of constriction in passing through the sclerotic ring. They divide close to the bottom of the central pit, the branches approaching close to its surface as they pass up its steep sides, and keeping near the surface over the swelling, but dipping a little at the outer boundary of the swelling.

Section of the swelling shows that it is everywhere infiltrated with small round nucleus-like bodies,  $\frac{1}{8000}$  to  $\frac{1}{3000}$  inch in diameter, which are aggregated densely in the neighbourhood of the vessels. They are scattered among abundant delicate fibres of connective tissue, which compose the chief bulk of the swelling, and course in various directions. Numerous small vessels exist throughout its substance, and many of the connective-tissue fibres are arranged concentrically around these. Others are distinguishable only by their direction and wavy character from the nerve fibres, which may be traced uninterruptedly through the swelling.

The retina on each side is pushed away from its normal place of commencement, being  $\frac{1}{30}$ th of an inch on each side from the edge of the choroidal ring. For a little distance it is greatly thickened, measuring  $\frac{1}{40}$ th of an inch in thickness at its commencement. The increased thickness depends chiefly on

thickening of the inner and outer nuclear layers, the internuclear layer being much narrowed. The nuclear layers present only a dense aggregation of such round corpuscles as those already described, and which resemble those normally constituting these layers. The layer of nerve fibres is also thickened, and contains similar nuclei. The retina further outwards gradually assumes perfectly normal characters.

The optic nerve contains many similar corpuscles, some aggregated along the vessels, others lying between the bundles of nerve fibres, others scattered through these bundles. They are more abundant just behind the sclerotic than farther back, but are present in about equal numbers throughout the whole length of optic nerve received.

The section of the bundles shows a granular appearance, the separate nerve fibres being less distinct than usual, but there are no other evidences of degeneration.

The amount of connective tissue between the bundles is not noticeably increased. That in the intervaginal space is however very abundant, the trabeculæ being numerous and thick.

*Eye No. 2.*—The appearances of this disc, retina, and optic nerve are essentially similar, except that the amount of swelling is rather less (Plate IV, Fig. 3). The height of swelling above the level of the choroidal ring is  $\frac{1}{30}$ th of an inch on the side on which the swelling is greatest, and rather less on the opposite side. The commencement of the retina is not displaced outwards so far as in the other eye. There is the same infiltration of the new connective-tissue and of the nerve-fibre layer with minute nuclei.

## REPORT ON THE PROGNOSIS IN TOBACCO AMAUROSIS.

BY JONATHAN HUTCHINSON.

For some years past I have taken much interest in the study of tobacco amaurosis, or that form of amblyopia which is so frequently met with in smokers. In 1864 I published, in the "London Hospital Reports," my first report on the subject; my second appeared in 1867, in the "Medico-Chirurgical Society's Transactions;" and a third in 1871, in vol. vii of these Reports. All these were more or less statistical, and comprised all the facts which I had been able to collect during each series of years. As years have passed on and experience has accumulated, my opinions respecting the malady in question have become more precise, and I have become able, I think, to exclude some sources of fallacy. It is not my intention, in the present report, to again examine the whole question, nor to add any additional series of cases. I propose to restrict my attention to one point—that of the estimation of the probability of recovery. As a rule, cases of this kind, being essentially chronic, are lost sight of as soon as the patient finds himself definitely improving. For many years, indeed, ever since I first recognised the importance of insisting upon the disuse of tobacco, I have been impressed with the fact that the disease of which formerly we thought most seriously did not appear to be a progressive one, and that at any rate we had no cases which continued under care and steadily got worse. I did not, however, until the last few years appreciate so fully as I do now the fact that most of them make *bonâ fide* recoveries. I thought it possible that many who ceased attending at the hospital might have gone to other hospitals, and been obliged to return to



their homes in the country without having been much benefited. An inquiry which I undertook in 1874, however, convinced me that the results had been much better than I had been ready to suppose. In that year, assisted by Mr. Nettleship, I wrote to all patients who had been under my care for tobacco amaurosis whose address I possessed, asking that they would either come up for examination or write and let me know their condition. The result was that we found that a large majority had quite recovered, and that scarcely any had got worse. Another remarkable and somewhat unexpected result was, that we found that many of those who had recovered had resumed the use of tobacco without detriment, most of them only to a small extent, but some almost to their former quantities. Those who had recovered had, all of them,—for a time at least—either abstained or greatly diminished their wonted consumption. The facts elicited in this inquiry and in another similar one which we have made this year in connection with my course of clinical lectures at Moorfields, are embodied in the following tables. Columns will be found devoted to the statement in precise terms of the degree to which sight had failed, and the extent to which it subsequently improved.

I have been, of course, from the beginning of my interest in this subject, emphatic in my advice as to the disuse of tobacco as a paramount measure of treatment, and I have therefore had very few cases under observation in which it has been possible to study the natural history of the disease when its cause is left in operation. I cannot say with any confidence whether in any large number of cases blindness would be the result under such circumstances or not. A few have, however, every now and then, come under observation at late periods of the disease, which support the belief that, at any rate in some, the disease is aggressive, and a few in which the patient had become blind. At the present time I have under care a coal-porter from Ipswich, who has gone blind to mere perception of light with all the usual symptoms, and who has continued to smoke throughout. I am inclined, therefore, to

believe, although my evidence is only fragmentary, that the prognosis is very bad if tobacco be not forbidden. Mackenzie pithily recorded his experience many years ago, that there were those "who would rather smoke than see;" and although I cannot say that I have met with many who showed quite that degree of obstinacy, yet I have little doubt that many of my patients who to me professed obedience, had really conformed only in part. It would appear, therefore, that reduction in quantity is efficacious and that abstinence is not absolutely necessary. I do not recollect for many years to have seen a single case diagnosed as tobacco amaurosis, which, in spite of treatment, went on from bad to worse. This is a very strong fact, and one which gives great support to the belief that tobacco is in these cases the real cause.

Although, as stated above, I do not intend here to discuss the general question, yet it may be convenient just briefly to record my present impressions respecting it.

I count as tobacco amaurosis those cases only in which the failure is absolutely equal in the two eyes. As a rule, the failure is gradual, and it is two or three months before the patient seeks advice. Indistinctness of sight and a "constant mist" are usually his complaints. In most there is no headache nor any other cerebral symptoms; usually there are no ophthalmoscopic signs, but sometimes the disc looks slightly hazy. Sometimes the digestion and general health have been somewhat disturbed, but more often the patient is in excellent vigour and has ailed nothing. Shag tobacco is the kind which has usually been employed, and the quantity usually not less than half an ounce (= about 15 grammes) a day. Total abstainers from stimulants are more liable to suffer than others, and although we sometimes meet with the disease in the intemperate, I have a strong impression that on the whole alcohol counteracts tobacco.

If the restricted description of tobacco amblyopia which I have suggested be accepted, I believe that no cases whatever will be found amongst women, and none in men who do not smoke. A few cases of primary white atrophy are met with

in women in which the disease resembles the tobacco cases in the early stages very exactly, but they always progress and end either in total blindness or in a condition nearly approaching it. It is probable that these very rare cases resemble the true tobacco cases in every respect excepting the cause, and that the reason why they never improve is simply that we are unable to remove the cause. A few parallel cases occur in male non-smokers, and it is possible that amongst smokers now and then a case may occur which is not wholly due to tobacco, and in which the prognosis may be much less hopeful. I may repeat that I do not recollect ever to have seen a woman threatened with failure of sight from primary atrophy, in which, after the symptoms had considerably advanced, recovery took place. It is in smokers only that the prognosis is so hopeful. Hence a strong additional argument in favour of the belief that tobacco is really the main—if not in most cases the sole—cause of the disease.

The annexed tables contain the facts as to progress in all the cases, 64 in number, of tobacco amaurosis, in which my notes are complete enough to give information on this point. Many of the cases have been published before, and are repeated here either without alteration or with the addition of notes made since their publication.

As the object of this summary is not to establish diagnostic points, but to help in the prognosis of the affection, no cases are given excepting those of which my notes extend over some time. In this way 63 of the cases, or just one half, are excluded as imperfect; the total number of which I have notes (including those given in my former reports) being 127.

The tables speak for themselves, but a few general statements drawn from a view of all the cases will, perhaps, serve to bring the more important facts into greater prominence.

I. *Recovery or great improvement of sight took place in 48 of the 64 cases (just 75 per cent.)* (Table I); the cure

being perfect, or almost so, in 31 of these (viz., Nos. 4, 6, 7, 8, 9, 11, 12, 13, 16, 17, 19, 23, 24, 25, 26, 27, 28, 31, 32, 34, 35, 36, 39, 40, 41, 42, 44, 45, 46, 47, 48); and of the remaining 17 all excepting 1 either lived at a distance and did not in writing give full information, or were under care for so short a time (from one to three months) that complete recovery could not be expected.

In 4 cases the disease was arrested, sight remaining stationary after a certain degree of failure (Table II).

In 7 cases sight became worse while under care (Table III), and 5 others were quite blind when first seen, and are believed to have continued so (Table IV).

II. *The relation between the duration and degree of the amblyopia and the rate and completeness of recovery.* The cases which come under care quite early get well quickly and completely (Nos. 17, 24, 32, 35, 39, 42, 45, 46); and this although there is no constant relation between the time and the degree of failure (see Nos. 17, 35, 42, 46); and cases of long duration may recover perfectly or very nearly so (Nos. 8, 11, 16, 19, 23, 34, 41, 47, 48), but their rate of improvement is usually slow in proportion to the degree of the defect. (The same cases.)

III. *Habits of the patients in regard to the use of tobacco before and after coming under care.*

Of the 48 patients who improved, 26 ceased smoking entirely while under care or for a longer time; and 13 others continued to smoke, but very much less than before. Of those who entirely left off tobacco for a time, 6 are known to have taken to smoking more or less some time after the sight had recovered, and in none did the sight again fail (Nos. 9, 17, 24, 28, 35, 41). Probably many others of whom this question was not asked would have given the same reply.

The quantity of tobacco had been increased before the sight began to fail in several cases (Nos. 3, 17, 20, 24, 43, 53, 58); in some others although there had been no increased quantity, symptoms of greater susceptibility to its influence had attracted the patients' attention (Nos. 31, 35, 64); whilst



a third group are noted as having been always comparatively intolerant of tobacco (Nos. 34, 36, 45, 54, 58, 63). Let it be noted especially that increased quantity, or disagreement, or habitual susceptibility were present in several of the cases which became worse or did not improve.

In not one of the cases in which improvement took place had the patient continued to smoke his full quantity. Of the 11 patients in whom the disease either did not improve, or became worse, no fewer than 8 had persisted in smoking their usual allowance throughout. This is a very strong fact.

IV. *Influence of other habits and previous state of health on the severity or course of the tobacco amaurosis.*

Those who are specially mentioned as in particularly good health, furnish several of the best and quickest recoveries (Nos. 13, 23, 26, 31, 40).

Several were either total abstainers from alcohol, or took so little as to be almost such (Nos. 1, 5, 14, 36, 38). Another (No. 24) had been an abstainer till a few years before, but had since taken a little beer on medical advice.

No doubt some of the patients were drinking to excess, but most of these were also smoking to excess, and such cases prove nothing as to the direct power of alcohol in causing amblyopia (Nos. 6, 15, 23, 32, 33, 35, 40, 42, 43, 45, 46, 53).

In a certain number besides those who were known drinkers, habitual indigestion or failure of appetite is noted (Nos. 18, 20, 27, 28, 31, 34, 44, 50, 51).

A history of special anxiety or trouble of some kind, or of overwork, was given by several patients, and would probably have been even more common if always asked for (Nos. 21, 22, 35, 39, 40, 41, 46, 48, 61). Another small group are noted as constitutionally nervous (Nos. 14, 30, 36, 39, 47). Only 2, however, complained of sleeping badly (Nos. 18, 44), and 3 others of too great sleepiness (Nos. 21, 41, 62).

V. *Influence of age.* Excellent recovery took place in several patients aged from 55 to 65 or more, and no special danger seems to be attached to advanced age in this malady.

Two of the worst cases, however, both of whom ceased smoking entirely, were old men (Nos. 58 and 59).

VI. *Other possible causes and special points.*

A few patients attributed the failure to exposure to great sun-heat or glare, and in all of these excepting one, the onset of amblyopia had been sudden or very rapid (Nos. 31, 32, 43, 54, 63). Sudden onset, however, occurred without mention of any special exposure to the sun in a few others, but even most of these occurred either in late spring or summer weather (Nos. 1, 10, 35, 42, 46, 55).

Several of the cases in Tables II, III, and IV, presented some points of difference from the ordinary cases of tobacco amblyopia. Thus there were other nerve symptoms in Nos. 56 and 62; much aching of the eyes was complained of in No. 55; and the disease was not quite symmetrical in onset or progress in Nos. 49, 50, 57, and 59. Whether such unusual symptoms are to be attributed to the influence of tobacco on certain constitutions, or whether their occurrence makes it probable that the amaurosis in such cases is really due to some other cause than tobacco, must for the present remain an open question.

*The Prognosis in Tobacco Amaurosis.*TABLE I.—*Cases in which Improvement or Recovery of Sight took place.*

(In the following Tables the original records of cases which have been published may be found by the abbreviations:—L.H.R. = London Hospital Reports, vol. i, p. 33, 1864; M.C.T. = Medico-Chirurgical Transactions, vol. i, p. 411, 1867; O.H.R. = Ophthalmic Hospital Reports, vol. vii, p. 169, 1871. The other letters refer to notes of cases not before published.)

| No. | Re-<br>ference.<br>Age. | Vision when first<br>seen. Duration of<br>Amblyopia. | Vision at subsequent dates.                                                                                                 | Habits as to Tobacco.                                  |                                                                                                       | State of Health before Failure<br>of Sight began.<br>Sexual System. Mode of<br>Onset, &c. Patient's<br>Impressions as to Cause.                       |
|-----|-------------------------|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                         |                                                      |                                                                                                                             | Before coming<br>under care.                           | After coming under<br>care.                                                                           |                                                                                                                                                       |
| 1   | L.H.R.<br>No. 19<br>46  | 14 J. barely.<br>1 mo.                               | Considerable improvement in<br>6 mos.                                                                                       | Smoked freely                                          | ..                                                                                                    | Total abstainer from alcohol<br>for 7 yrs. before failure of<br>sight. Sight failed rapidly,<br>in 1 day. Discs congested<br>and slightly hazy.<br>.. |
| 2   | M.C.T.<br>No. 11<br>42  | 19 J.<br>5 mos.                                      | In 3 mos. = 11 J. (and with<br>+ glasses 6 J.), and $\frac{29}{20}$ .                                                       | $\frac{1}{2}$ oz. daily                                | ..                                                                                                    | ..                                                                                                                                                    |
| 3   | M.C.T.<br>No. 16<br>30  | 16 J., not<br>5 mos.                                 | In 10 mos. = 6 J. with diffi-<br>culty and $\frac{29}{20}$ .                                                                | Smoked and<br>chewed 1 oz.<br>daily for last<br>5 yrs. | Ceased smoking while<br>under care. No later<br>note.<br>Ceased smoking while<br>under care (11 mos.) | Has smoked twice as much<br>last 5 yrs. as previously.                                                                                                |
| 4   | O.H.R.<br>No. 7<br>45   | 14 or 16 J., $\frac{29}{20}$ .<br>3 mos.             | In 2 mos. = 14 J., $\frac{29}{20}$ .<br>12 mos. = 8 J., $\frac{29}{20}$ .<br>15 mos. = 6 J. barely<br>17 mos. = 4 J. barely | Smoked "as<br>much as he<br>could get"                 | Ceased during first<br>2 mos. of treatment.<br>No later note.                                         | ..                                                                                                                                                    |

TABLE I.—Cases in which Improvement or Recovery of Sight took place—continued.

| No. | Re-<br>ference.<br>Age.     | Vision when first<br>seen. Duration of<br>Amblyopia. | Vision at subsequent dates.                                                                                                  | Habits as to Tobacco.        |                                                                                                       | State of Health before Failure<br>of Sight began.<br>Sexual System. Mode of<br>Onset, &c. Patient's<br>Impressions as to Cause.           |
|-----|-----------------------------|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
|     |                             |                                                      |                                                                                                                              | Before coming<br>under care. | After coming under<br>care.                                                                           |                                                                                                                                           |
| 5   | O.H.R.<br>No. 8<br>42       | 16 J., $\frac{20}{100}$ .<br>2 mos.                  | In 1 mo. = 14 J., $\frac{20}{100}$ ..                                                                                        | $\frac{1}{2}$ oz. daily ..   | ..                                                                                                    | Total abstainer from alcohol<br>last 2 yrs.                                                                                               |
| 6   | O.H.R.<br>No. 12<br>61      | $\frac{20}{70}$ .<br>2 mos.                          | In 2 mos. = 6 J. (with + ),<br>$\frac{20}{80}$ .<br>In 11 mos. = "Can see to<br>read the newspaper."<br>In 3½ mos. = 2 J. .. | $\frac{1}{2}$ oz. daily ..   | Ceased smoking at<br>least a year.                                                                    | A great drinker; spirits and<br>beer.                                                                                                     |
| 7   | O.H.R.<br>No. 16<br>No note | 10 J., $\frac{20}{100}$ .<br>6 mos.                  | In 3 mos. = 10 J.<br>In 4½ mos. = 4 J. slowly,<br>without +.                                                                 | $\frac{1}{2}$ oz. daily ..   | Did not quite cease<br>smoking.                                                                       | ..                                                                                                                                        |
| 8   | O.H.R.<br>No. 19<br>54      | 16 J., $\frac{20}{100}$ .<br>12 mos.                 | 4½ yrs. later = "Sight much<br>improved: with glasses can<br>read newspaper."                                                | $\frac{1}{2}$ oz. daily ..   | Continued to smoke a<br>little ( $\frac{1}{2}$ oz. a month).                                          | ..                                                                                                                                        |
| 9   | O.H.R.<br>No. 14<br>53      | 16 J., $\frac{20}{80}$ .<br>6 mos.                   | 4½ yrs. later = "My eyes<br>have wonderfully im-<br>proved."                                                                 | $\frac{1}{2}$ oz. daily ..   | Ceased for about 1½ yr.<br>Since then has again<br>smoked for last 3 yrs.<br>$\frac{1}{4}$ oz. daily. | ..                                                                                                                                        |
| 10  | O.H.R.<br>No. 17<br>60      | 14 or 16 J., $\frac{20}{100}$ .                      | 4½ yrs. later = "My eyes<br>have wonderfully im-<br>proved."                                                                 | $\frac{1}{2}$ oz. daily ..   | ..                                                                                                    | Sight failed rapidly, in one<br>night, and after this it re-<br>mained stationary till he<br>came under care. Discs<br>pale on Y.S. side. |



|    |                        |                                              |                                                                                                                                                                                        |                                          |    |                                                                                                                                                                       |                                                                                                              |
|----|------------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| 11 | O.H.R.<br>No. 21<br>50 | 20 J., $\frac{20}{1000}$ .<br>15-18 mos.     | In 9 mos. = 14 J., $\frac{20}{1000}$ .<br>4 yrs. = "my sight is as<br>good as ever it was."                                                                                            | $\frac{1}{2}$ oz. daily                  | .. | Ceased entirely for at<br>least 6 mos.                                                                                                                                | ..                                                                                                           |
| 12 | O.H.R.<br>No. 25<br>35 | 8 J., $\frac{20}{1000}$ .<br>6 mos.          | In 2 mos. = 4 J., $\frac{20}{1000}$ .<br>6 mos. = 1 J. (barely) $\frac{30}{1000}$ .<br>9 mos. = the same.                                                                              | $\frac{1}{2}$ oz. daily                  | .. | Ceased entirely for<br>6 mos., with benefit<br>to appetite                                                                                                            | On admission is said to<br>have been "very nervous<br>lately,"                                               |
| 13 | O.H.R.<br>No. 29<br>36 | 12 J., $\frac{20}{1000}$ .<br>6 mos.         | In 1 mo. = 2 J. barely, and<br>$\frac{30}{1000}$ .<br>In 2 mos. = 1 J. easily, and<br>$\frac{20}{1000}$ .<br>In 4 yrs. = the same.                                                     | 1 oz. daily                              | .. | Never quite ceased,<br>but diminished the<br>quantity very much,<br>and was still smoking<br>a little at date of<br>last note, 4 years<br>after coming under<br>care. | In splendid health through-<br>out. A remarkably vigor-<br>ous man.                                          |
| 14 | G. 85<br>51            | 18 J., $\frac{20}{1000}$ .<br>1 mo. or more. | In 2 mos. = 10 J.<br>5 mos. = 8 J.<br>2½ yrs. = same; no worse.                                                                                                                        | $\frac{1}{4}$ to $\frac{1}{2}$ oz. daily | .. | Never quite ceased,<br>but diminished very<br>much; was still<br>smoking a little at<br>last note, 2½ yrs.<br>after admission.                                        | Drinks very little; some-<br>times has no alcohol at all<br>for several days. Pale,<br>thin, nervous.        |
| 15 | M.C.T.<br>No. 2<br>46  | 18 J.<br>3 mos.                              | In 11 mos. = "considers that<br>he can see much better."                                                                                                                               | $\frac{1}{2}$ oz. daily                  | .. | ..                                                                                                                                                                    | A spirit drinker; tremulous<br>from drink.                                                                   |
| 16 | G. 73<br>62            | 16 J., $\frac{20}{1000}$ .<br>About 2 yrs.   | In 2 mos. = 10 J., and with<br>+ glasses = 2 J.; and $\frac{20}{1000}$ .<br>In 2½ yrs. = "with glasses<br>can see better than I have<br>done for 5 yrs.; can see to<br>read anything." | 1 oz. daily                              | .. | Did not quite cease<br>smoking.                                                                                                                                       | ..                                                                                                           |
| 17 | G. 139<br>61           | 16 J., $\frac{20}{1000}$ .<br>About 6 weeks. | In 4 mos. = the same; +<br>glasses for reading do not<br>help. In 2½ yrs. = 4 J.,<br>with his glasses.                                                                                 | $\frac{1}{2}$ oz. to 1 oz.<br>daily.     | .. | Perhaps ceased en-<br>tirely for a short<br>time; for last 2 yrs.,<br>or so, has again                                                                                | Appetite failed several mos.<br>before sight. Had been<br>smoking more than usual.<br>Had been getting weak. |

TABLE I.—Cases in which Improvement or Recovery took place—continued.

| No. | Re-<br>ference.<br>Age. | Vision when first<br>seen. Duration of<br>Amblyopia.       | Vision at subsequent dates.                                    | Habits as to Tobacco.                      |                                                                                                                                        | State of Health before Failure<br>of Sight began.<br>Sexual System. Mode of<br>Onset, &c. Patient's<br>Impressions as to Cause.                                                                                                                                |
|-----|-------------------------|------------------------------------------------------------|----------------------------------------------------------------|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                         |                                                            |                                                                | Before coming<br>under care.               | After coming under<br>care.                                                                                                            |                                                                                                                                                                                                                                                                |
| 18  | G. 243<br>42            | 10 J., $\frac{20}{70}$ .<br>6 mos.                         | In 1½ yrs. writes, "my sight<br>is a great deal better."       | ½ oz. daily ..                             | smoked, but only ½<br>to ¾ daily.<br><br>Probably ceased en-<br>tirely for several<br>mos. while under<br>treatment. No later<br>note. | Health improved while un-<br>der treatment. O. D. No<br>changes when first seen<br>2½ yrs. later, then Y. S. sides<br>somewhat pale.<br>Was sleeping badly and<br>eating badly when sight<br>began to fail.                                                    |
| 19  | G. 66<br>67             | 10 J., $\frac{20}{100}$ (with M. Y.<br>corrected.) 12 mos. | In 5 mos. = 4 J.<br>In 2½ yrs. = "sight quite re-<br>covered." | 1 oz. or more<br>daily.                    | Ceased for at least<br>3 mos. No later<br>note.                                                                                        | ..                                                                                                                                                                                                                                                             |
| 20  | G. 145<br>24            | 16 J., $\frac{20}{40}$ .<br>11 mos.                        | In 2 yrs. = "my sight has<br>greatly improved."                | 1 oz. daily late-<br>ly; formerly<br>less. | Had ceased entirely<br>3-4 mos. before com-<br>ing under care. No<br>later note.                                                       | Had smoked more than usual<br>for some months before V.<br>failed, and appetite had<br>been bad during same<br>time. V. was getting much<br>worse when he ceased<br>smoking, but remained<br>stationary for some months<br>afterwards, and then im-<br>proved. |

|    |               |                                              |                                                                                                                                                                                                                                                               |                                               |                                                                                                              |                                                                                                                                                                                                        |
|----|---------------|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 21 | Gt. 255<br>48 | 16 J., $\frac{20}{200}$ .<br>9 mos.          | In 3 mos. = 10 J. $\frac{20}{200}$ . Myopic. With — 36 = $\frac{20}{20}$ .                                                                                                                                                                                    | $\frac{1}{2}$ to $\frac{2}{3}$ oz. daily      | Diminished very much, but did not quite cease smoking while under care.                                      | Had much anxiety from failure in business about time when V. began to fail. Amblyopia accompanied by sleepiness. A portly, strong-looking man. Appetite good.                                          |
| 22 | F. 325<br>51  | R. 16 J. $\frac{20}{200}$ , L. 19 J. 7 mos.  | In 2½ mos. = R. 10 J., L. 16 J.                                                                                                                                                                                                                               | $\frac{1}{4}$ oz. daily ..                    | ..                                                                                                           | Had much anxiety for a year before V. failed (wife's illness and death). Has lost flesh, and become nervous. Has not increased his tobacco. It is noted that he sees best in the morning.              |
| 23 | F. 219<br>36  | 20 J., not $\frac{20}{200}$ .<br>8 or 9 mos. | In 3½ yrs. = he is "entirely cured," and his eyes "as well as ever they were."                                                                                                                                                                                | $\frac{1}{4}$ oz. daily, or less.             | ..                                                                                                           | Powerful, healthy-looking man. Brewer's labourer. Not in the least nervous. Drinks much beer, but is seldom drunk. V. said to vary much on different days. Marked pallor of V. S. sides of O.Ds.       |
| 24 | F. 149<br>28  | R. 10 J. $\frac{20}{200}$ , L. 8 J. 6 wks.   | In 2 mos. = 2 J. with each eye.<br>In 4 mos. = 1 J. pretty easily, and $\frac{20}{200}$ .<br>In 3½ yrs. = "Can see as well as ever I could," and has been as well as this for 3 yrs. Complete recovery in 6 mos.<br>In 5 mos. = 16 J., and with glasses 10 J. | 1 oz. daily, for past 12 mos.; formerly less. | Ceased for about 1½ yrs. Since then has smoked again for the last 2 yrs., but not quite so much as formerly. | Failure coincident with increase in tobacco. Was a total abstainer from alcohol till Oct. 24; since then, on medical advice, has drunk 1 pint beer daily; was advised to do so after a slight illness. |
| 25 | Gt. 80<br>51  | 20 J., not $\frac{20}{200}$ .<br>3 mos.      | ..                                                                                                                                                                                                                                                            | $\frac{1}{4}$ to $\frac{1}{2}$ oz. daily      | Asserts that he quite ceased smoking from                                                                    | ..                                                                                                                                                                                                     |

TABLE I.—Cases in which Improvement or Recovery of Sight took place—continued.

| No. | Re-<br>ference.<br>Age. | Vision when first<br>seen. Duration of<br>Amblyopia.                                | Vision at subsequent dates.                                                                                                                                                                                                            | Habits as to Tobacco.                     |                                                                                                                                                                                                                                              | State of Health before Failure<br>of Sight began.<br>Sexual System. Mode of<br>Onset, &c. Patient's<br>Impressions as to Cause.                                                                                                                         |
|-----|-------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                         |                                                                                     |                                                                                                                                                                                                                                        | Before coming<br>under care.              | After coming under<br>care.                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                         |
| 26  | G. 141<br>54            | 16 J., and with + 7<br>= 1 J. barely, held<br>close, and $\frac{2}{3}$ o.<br>9 mos. | In 3 yrs. = 4 J. with glasses,<br>and $\frac{2}{3}$ o.<br>In 2 yrs. writes, "Sight much<br>improved, and as good as I<br>can expect at my age."                                                                                        | $\frac{1}{2}$ oz. daily ..                | date of admission to<br>last note, 3 yrs. later.<br>..                                                                                                                                                                                       | Pallor of Y. S. part of each<br>O. D. Slight haze, and<br>swelling of remainder;<br>rather more marked in L.<br>V. best in the morning,<br>and at dusk. Robust,<br>healthy; sleeps and eats<br>well.<br>Slight failure of appetite for<br>about a year. |
| 27  | G. 175<br>34            | 14 J., $\frac{2}{3}$ o. No note.                                                    | In 2 yrs. writes, "Sight very<br>much improved; can see to<br>read a newspaper."<br>In 2 mos. = 6 J.; with<br>glasses 1 J. fairly.<br>In 7 mos. = 2 J. slowly, with-<br>out glasses.<br>In 2 yrs. = remains same; V.<br>nearly normal. | $\frac{1}{2}$ oz. daily ..                | ..                                                                                                                                                                                                                                           | Failure of appetite about<br>12 mos. before admission.<br>O.Ds. on admission con-<br>gested and somewhat<br>swollen and slightly hazy;<br>vessels not obscured. In<br>7 mos., O.Ds. not swollen;<br>doubtful slight pallor. (A<br>different observer.)  |
| 28  | G. 162<br>57            | 10 J., $\frac{2}{3}$ o.<br>2 or 3 mos.                                              |                                                                                                                                                                                                                                        | $\frac{1}{2}$ oz. daily of<br>"Cavendish" | Continued smoking for<br>the 1st mo. of treat-<br>ment. Then ceased<br>entirely, and in 1 mo.<br>appetite and health<br>had greatly im-<br>proved. Continued<br>to abstain from to-<br>bacco for about 1 $\frac{1}{2}$ yr.<br>Since then has |                                                                                                                                                                                                                                                         |

|    |                                                  |                                                               |                                                                                                                                                                                                                                  |                                                          |                                                           |                                                                                                                                                                                                                                                           |
|----|--------------------------------------------------|---------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 29 | M.C.T.<br>No. 3<br>41                            | 16 J. barely.<br>2 mos.                                       | In 2 mos. = 6 J. barely ..                                                                                                                                                                                                       | 1 oz. daily ..                                           | smoked a little, without any relapse of amblyopia.<br>..  | No material change in O.Ds. Some observers thought Y. S. rather pale; others thought there was congestion.                                                                                                                                                |
| 30 | (Loose notes.<br>Mr. T.'s friend)<br>33          | 16 J. barely.<br>7 mos.                                       | Improved so that he could see to read.                                                                                                                                                                                           | 1 oz. daily;<br>"Cavendish"<br>or "shag."                | Diminished, but never left off, smoking.                  | In good health apparently, but very nervous, and of a "nervous family." Died of phthisis a year or two after I saw him.                                                                                                                                   |
| 31 | H <sup>3</sup> , 210<br>44<br>(Private)          | 10 J. barely, and<br>$\frac{20}{80}$ .<br>8 mos               | In 1 mo. = 8 J. fairly.<br>2 mos. = 6 J., $\frac{20}{80}$ .<br>In 3 mos. = 1 J. slowly, $\frac{20}{80}$ ; but complains of a dimness in the middle of the type when reading. No central scotoma can be detected on white ground. | A heavy smoker, chiefly cigars.                          | Ceased entirely during the 3 mos. that he was under care. | Sudden onset in Japan, after exposure to bright sun-light when in an open boat on sea; continued to fail for a month afterwards. Smoking often made him nervous. Had some indigestion. A very intelligent gentleman; an engineer.                         |
| 32 | H <sup>3</sup> , 41<br>45<br>(Private)<br>a Dane | 1 J. barely, with<br>glasses; and $\frac{20}{80}$ .<br>3 wks. | In 12 days = 2 J. without glasses; and $\frac{20}{80}$ .<br>In 1 mo. = 1 J. easily without glasses.                                                                                                                              | Smokes as much as he can get, and the strongest tobacco. | Ceased smoking almost entirely while under care.          | Drinks largely also. Amblyopia accompanied by intolerance of light, especially blue. Attributes failure to exposure to bright light. Gas light does not annoy him. Once in childhood had snow blindness. Very slight pressure on eyeballs makes V. worse. |



TABLE I.—Cases in which Improvement or Recovery of Sight took place—continued.

| No. | Re-<br>ference<br>Age.                  | Vision when first<br>seen. Duration of<br>Amblyopia.                                                    | Vision at subsequent dates.                                                                                     | Habits as to Tobacco.                           |                                                                                                                              | State of Health before Failure<br>of Sight began.<br>Sexual System. Mode of<br>Onset, &c. Patient's<br>Impressions as to Cause.                                                                                                                                                           |
|-----|-----------------------------------------|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                                         |                                                                                                         |                                                                                                                 | Before coming<br>under care.                    | After coming under<br>care.                                                                                                  |                                                                                                                                                                                                                                                                                           |
| 33  | H <sup>2</sup> , 392<br>60<br>(Private) | About $\frac{8}{70}$ . 1 $\frac{1}{2}$ or<br>2 yrs. Still fail-<br>ing.                                 | In 1 mo. = $\frac{3}{50}$ ; slight im-<br>provement.<br>In 3 mos. = 1 J. and $\frac{2}{50}$ .                   | A heavy smoker<br>$\frac{1}{2}$ to 1 oz. daily  | Diminished but did<br>not cease entirely.<br>Diminished at medi-<br>cal advice 2 mos.<br>before I saw him.<br>No later note. | Nervous and shaky. The<br>photophobia and nervous-<br>ness diminished in propor-<br>tion as V. improved.<br>An intemperate undertaker,<br>tremulous and pale.                                                                                                                             |
| 34  | H <sup>2</sup> , 303<br>40              | 3 J. barely, and<br>$\frac{2}{50}$ . 9 mos.                                                             |                                                                                                                 |                                                 |                                                                                                                              | Appetite diminished some-<br>what, and he lost much<br>flesh. Had great difficulty<br>in learning to smoke, and<br>his father never could<br>learn.                                                                                                                                       |
| 35  | G. 277<br>33                            | 10 J. barely; $\frac{2}{50}$ , in<br>dull light. 4 J.,<br>$\frac{2}{50}$ , in good light.<br>5-6 weeks. | In 14 mos. = 1 J., $\frac{2}{50}$ , with<br>each eye, easily. Has<br>been as well as this for<br>nearly a year. | $\frac{1}{2}$ oz. daily; rather less<br>lately. | Ceased smoking<br>entirely for 8 mos.<br>Since then has again<br>smoked, but only<br>1 oz. a week.                           | Was also drinking too much.<br>Had lately thought smok-<br>ing disagreed, and had<br>somewhat diminished it.<br>For a year before failure<br>had been working much<br>harder than previously, but<br>had no anxiety. In tolerable<br>health, but somewhat tre-<br>mulous. Health improved |

|    |              |                                                                |                                                                                                                                                                                                                 |                                             |                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----|--------------|----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 36 | G. 316<br>50 | 16 J., $\frac{20}{100}$ .<br>3 mos.                            | In 3 mos. = 10 J. (words),<br>$\frac{20}{100}$ ; with his + glasses = 6 J.<br>badly.<br>In 4 mos. = (with his glasses)<br>reads 4 J. badly and 6 J.<br>well.<br>In 6 mos. = the same.<br>In 12 mos. = the same. | Of late only<br>$\frac{1}{2}$ oz. weekly.   | Ceased entirely, while<br>under care, and pro-<br>bably has not re-<br>sumed. | much while under care.<br>Diminished alcohol as well<br>as tobacco. Failure was<br>rapid, in 2 or 3 days, in De-<br>cember; considered sight<br>always better for half an<br>hour after getting up in<br>morning. Ophth. negative.<br>Very susceptible to tobacco,<br>and latterly had diminished<br>the quantity. Easily af-<br>fected by alcohol, and takes<br>very little, often less than<br>1 pint beer daily, never<br>more. Has been to sea<br>several times, and always<br>very sick. Small, spare<br>man, very nervous; abun-<br>dant acne, rosaceous and<br>pustular. Had lost sexual<br>power 3 mos. before admis-<br>sion. |
| 37 | G. 343<br>46 | 14 J., $\frac{20}{100}$ .<br>5-6 mos.                          | In 1 mo. = some improve-<br>ment.<br>In 11 mos. = "sight has<br>greatly improved." (Lives<br>at a distance, and cannot<br>come to be tested.)                                                                   | $\frac{1}{4}$ oz daily                      | Ceased entirely for a<br>year; has not re-<br>sumed.                          | A nervous, tremulous man;<br>probably drinks, but will<br>not admit it. Health im-<br>proved after he ceased<br>smoking. There was slight<br>uniform haze of retinae and<br>disks; scarcely any pallor<br>of Y. S. sides of disks.                                                                                                                                                                                                                                                                                                                                                                                                     |
| 38 | G. 381<br>46 | R. 18 J. barely;<br>L. 20 J.; and $\frac{20}{100}$ .<br>6 mos. | In 2 mos. = R. 16 J., L. 18 J.<br>barely.                                                                                                                                                                       | $\frac{1}{4}$ oz. daily, or<br>rather more. | Diminished for the<br>first 2 mos., and then<br>ceased entirely.              | Tobacco never disagrees.<br>2 yrs. ago left off all alcohol<br>for 18 mos. Has again                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

TABLE I.—Cases in which Improvement or Recovery of Sight took place—continued.

| No. | Re-<br>ference.<br>Age. | Vision when first<br>seen. Duration of<br>Amblyopia.                                                                 | Vision at subsequent dates.                                                                                                                                                                                                                                       | Habits as to Tobacco.                     |                                                                                     | State of Health before Failure<br>of Sight began.<br>Sexual System. Mode of<br>Onset, &c. Patient's<br>Impressions as to Cause.                                                                                                                                                                                                                                                                                                          |
|-----|-------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                         |                                                                                                                      |                                                                                                                                                                                                                                                                   | Before coming<br>under care.              | After coming under<br>care.                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 39  | G. 14<br>40             | 8 J., $\frac{20}{20}$ .<br>6-8 wks.                                                                                  | In 4 mos. = R. 10 J., L. 16 J.<br>$\frac{20}{20}$ . Sees better in evening,<br>and with eyes shaded. A<br>few floating opacities in<br>each vitreous.<br><br>In 2 mos. = 4 J., $\frac{20}{20}$ .<br>In 7 mos. = 1 J. faintly, at<br>10" ; $\frac{20}{20}$ partly. |                                           |                                                                                     | taken a little, but much<br>less than formerly, for<br>4-5 mos. before coming<br>under care. Failure began<br>rather quickly and pro-<br>gressed.<br>Had had much worry for<br>some months before failure<br>began ; an emotional man ;<br>nearly cried in telling his<br>story. Took nux vomica<br>only 1 wk. Continued to<br>improve, after he ceased<br>attending hospital. The<br>worry, &c., had not affected<br>appetite or sleep. |
|     |                         |                                                                                                                      |                                                                                                                                                                                                                                                                   | $\frac{1}{2}$ oz. daily ..                | Ceased entirely, and<br>had not resumed at<br>last note, 7 mos. after<br>admission. | A Calcutta merchant (Eng-<br>lish) ; ruddy, robust, with<br>tendency to corpulence ; in<br>excellent health when seen<br>(August, 1875). Has been<br>18 yrs. in India, and has<br>drunk heavily (brandy and                                                                                                                                                                                                                              |
| 40  | G. 161<br>34            | Nov., 1874, began.<br>In 6 mos., " could<br>not see whether<br>people were sit-<br>ting or standing"<br>(May, 1875). | In 3 mos. (Aug. 1875) = 4 J.,<br>$\frac{20}{20}$ .                                                                                                                                                                                                                | $\frac{1}{2}$ oz. daily of<br>"Cavendish" | In May, 1875, di-<br>minished, but pro-<br>bably did not leave<br>off entirely.     |                                                                                                                                                                                                                                                                                                                                                                                                                                          |

beer), and smoked heavily all the time, and without causing any bad symptoms, excepting dyspepsia for last 2-3 yrs. Not in the least nervous. The failure began after several months of great business anxiety (bankruptcy); the relation between the two seems well marked. Was told in India that the blindness was chiefly due to spirit drinking. Discs very pale on Y.S. third; pallor ends *quite abruptly*, the remaining two-thirds being healthy or too red. The atrophic third bordered by narrow crescent of partly atrophied choroid.

Had had much anxiety (failure in business) about time when failure of sight began. Had been too sleepy of late. A portly, strong man. Soon nervous under anxiety. His testimony as to improvement is that with the glasses, which were ordered soon after admission, he could not see for the first 6 mos.,

Ceased entirely for about 3 mos. Since then has resumed about 1 oz. weekly.

$\frac{1}{2}$  oz. to 1 oz. daily

In 3 mos. = 10 J.,  $\frac{20}{100}$ ; with  $-\frac{1}{36}$  =  $\frac{20}{70}$ .  
In 7 mos. = 6 J. slowly without glasses; " with glasses can read anything."  
For last 3 weeks has again been nervous and worried about money, and V. has become rather worse again.

16 J.,  $\frac{20}{100}$ .  
9 mos.

G. 255  
48

41

TABLE I.—Cases in which Improvement or Recovery of Sight took place—continued.

| No. | Re-<br>ference.<br>Age. | Vision when first<br>seen. Duration of<br>Amblyopia. | Vision at subsequent dates.                                                                                  | Habits as to Tobacco.                                                                          |                                                                                                   | State of Health before Failure<br>of Sight began.<br>Sexual System. Mode of<br>Onset, &c. Patient's<br>Impressions as to Cause.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----|-------------------------|------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                         |                                                      |                                                                                                              | Before coming<br>under care.                                                                   | After coming under<br>care.                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 42  | G. 269<br>42            | 16 J., $\frac{20}{1200}$ .<br>7 wks.                 | In 6 wks. = 8 J., $\frac{20}{70}$ .<br>3 mos. = 2 J. very fairly.                                            | Smokes ex-<br>cessively, "2 or<br>3 ozs. daily."                                               | Diminished to one or<br>two pipes a week for<br>3 mos., and then<br>ceased entirely.              | and that now he can read<br>any print.<br>Drinks heavily also (beer).<br>Failure sudden: "while<br>hoosing some onions 3 rows<br>seemed to go into 1;"<br>thinks it improved slightly<br>for a week and then re-<br>mained stationary till ad-<br>mission. Failure of appe-<br>tite lately: this improved<br>when he ceased smoking.<br>Had also drunk heavily,<br>chiefly beer, but apparently<br>not injured by it. Failure<br>sudden while off W. Coast<br>of Africa; could see to read<br>one day and the next day<br>could not. Was on way to<br>Australia; while there V. got<br>rather worse for a time and<br>then began to improve a<br>little; improvement con- |
| 43  | G. 263<br>21            | 19 J., $\frac{20}{0}$ .<br>9½ mos.                   | In 3 mos. = 16 J. held<br>close, $\frac{20}{0}$ .<br>In 8 mos. = "sight is better"<br>(lives at a distance). | 1 oz. daily of<br>"Cavendish"<br>for a year<br>past. Smaller<br>quantity for<br>3 yrs. before. | Ceased entirely 2 wks.<br>before coming under<br>my care. Had pre-<br>viously seen Mr.<br>Bowman. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |



|    |             |                                     |                                                                                                                                                                                                                                                                                                                                      |                                                             |                                                                                                                                                               |                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----|-------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 44 | J. 15<br>40 | 16 J., $\frac{20}{100}$ .<br>9 wks. | In 2 mos. = 10 J., $\frac{20}{100}$ .<br>In 3 mos. = 4 J., $\frac{20}{100}$ .<br>In 7 mos. = 1 J. slowly.                                                                                                                                                                                                                            | $\frac{1}{2}$ oz. daily ..                                  | Substituted a smaller quantity of much milder tobacco for the former $\frac{1}{2}$ oz. of "shag."<br>Ceased entirely up to last note, 4 mos. after admission. | For 2 or 3 yrs. digestion and appetite have failed somewhat. Had latterly been sleeping badly. | tinued to some extent up to time that he ceased smoking. Thus improvement began (according to his statement) while still smoking full quantity. A heavy, lethargic lad. <i>Discs</i> uniformly very pale, creamy white; arteries decidedly diminished. On centre of L. disc a small patch of haze which quite obscures a vessel there. Choroid notched at Y.S. side. Mr. Bowman had previously noted that he was "said to have had neuritis." |
| 45 | J. 42<br>39 | 10 J. barely;<br>2 mos.             | In 1 mo. = 4 J., $\frac{20}{100}$ . "Much improved."<br>In 4 mos. = "sight getting a little stronger."<br>In $2\frac{1}{2}$ mos. = 12 J., $\frac{20}{100}$ . Now for first time left off smoking.<br>In 3 mos. after ceasing to smoke = 8 or 10 J., $\frac{20}{100}$ , or $\frac{70}{100}$ .<br>In 5 mos. = 4 J., $\frac{20}{100}$ . | $\frac{1}{2}$ oz. daily ..                                  | Ceased entirely up to last note, 4 mos. after admission.                                                                                                      | Over-smoking disagrees. Drinks heavily at times, but irregularly.                              | tinued to some extent up to time that he ceased smoking. Thus improvement began (according to his statement) while still smoking full quantity. A heavy, lethargic lad. <i>Discs</i> uniformly very pale, creamy white; arteries decidedly diminished. On centre of L. disc a small patch of haze which quite obscures a vessel there. Choroid notched at Y.S. side. Mr. Bowman had previously noted that he was "said to have had neuritis." |
| 46 | J. 35<br>42 | 12 J., $\frac{20}{100}$ .<br>6 wks. | In 2 mos. = 12 J., $\frac{20}{100}$ . Now for first time left off smoking.<br>In 3 mos. after ceasing to smoke = 8 or 10 J., $\frac{20}{100}$ , or $\frac{70}{100}$ .<br>In 5 mos. = 4 J., $\frac{20}{100}$ .                                                                                                                        | 1 oz. <i>weekly</i> ,<br>for the last 7 yrs. Formerly more. | Continued to smoke for $2\frac{1}{2}$ mos, after admission. Then ceased entirely till date of last note, 5 mos. later.                                        | Over-smoking disagrees. Drinks heavily at times, but irregularly.                              | tinued to some extent up to time that he ceased smoking. Thus improvement began (according to his statement) while still smoking full quantity. A heavy, lethargic lad. <i>Discs</i> uniformly very pale, creamy white; arteries decidedly diminished. On centre of L. disc a small patch of haze which quite obscures a vessel there. Choroid notched at Y.S. side. Mr. Bowman had previously noted that he was "said to have had neuritis." |

Smoking did not disagree, and he diminished quantity 7 yrs. ago, only because his employment prevented him from smoking so much. Sight failed suddenly about Midsummer, while walk-

TABLE I.—Cases in which Improvement or Recovery of Sight took place—continued.

| No. | Re-<br>ference.<br>Age. | Vision when first<br>seen. Duration of<br>Amblyopia.                                         | Vision at subsequent dates.                                                                                                                 | Habits as to Tobacco.        |                             | State of Health before Failure<br>of Sight began.<br>Sexual System. Mode of<br>Onset, &c. Patient's<br>Impressions as to Cause.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----|-------------------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                         |                                                                                              |                                                                                                                                             | Before coming<br>under care. | After coming under<br>care. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 47  | Rev.<br>Mr. S.          | Could not recognise<br>his wife's features.<br>Rather rapid fail-<br>ure in Summer,<br>1869. | Remained stationary for<br>about 6 months after having<br>ceased to smoke. Then be-<br>gan to improve, and re-<br>covered almost completely | Smoked mode-<br>rately.      | Ceased entirely             | ing in the London streets ;<br>did not get much worse.<br>Had had some anxiety<br>about family affairs before<br>V. failed. Was probably<br>drinking rather too much,<br>and tongue rather tremu-<br>lous, but appeared in very<br>good health ; appetite was<br>bad in morning. At last<br>note, had diminished his<br>alcohol, but did not con-<br>sider his health either<br>better or worse since at-<br>tendance ; did not think<br>he had ever been injured,<br>either by smoking or alco-<br>hol.<br>Was a nervous man, a mis-<br>sionary. Was advised to<br>smoke, partly for com-<br>panionship, partly to cure<br>his nervousness, while in |

the Sandwich Islands. The recovery in this case was most remarkable and unexpected.

A very young man when failure began. Failure occurred during a time of great business anxiety and hard work. Having become blind, he changed occupation, and became a minister, not working so hard; and soon gave up smoking, as unsuited to his new course of life, not with any hope of recovery. It is doubtful whether this case is one of primary atrophy; I did not see the patient until the blindness was complete. He never had other indications of nerve disease, and is now in good health.

in about 6 months. Can now read 2 J. fairly with glasses.

After remaining quite blind and reading by raised alphabet for 2 or 3 yrs. he gradually regained sight, and became able to read small print. The recovery is permanent. Discs have remained pale.

Became so blind, while in business, that he had to give up, and a certificate of permanent blindness was given. Learnt to read afterwards by the raised alphabet. Blindness complete in 12 mos.

Mr. B.  
L. H. R.  
No. 39

48

Ceased entirely some time after having become quite blind.

Smoked moderately.

TABLE II.—*Cases which remained Stationary.*

| No. | Re-ference. Age.                                 | Vision when first seen. Duration of Amblyopia. | Vision at subsequent dates.                                                                                                                                                     | Habits as to Tobacco.     |                                | State of Health before Failure of Sight began. Sexual System. Mode of Onset, &c. Patient's Impressions as to Cause.                                                                                                                                                                                                                             |
|-----|--------------------------------------------------|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                                                  |                                                |                                                                                                                                                                                 | Before coming under care. | After coming under care.       |                                                                                                                                                                                                                                                                                                                                                 |
| 49  | L.H.R. No. 45<br>41 when failure began.          | 18 J. barely.<br>6 yrs.                        | Failure began 6 yrs. ago. Now est. 47. V. has been stationary for about 4 yrs. Much troubled with muscæ. Sight not now quite so bad as it was a year after failure began.       | $\frac{1}{2}$ oz. daily   | Continued to smoke throughout. | Ruddy and robust; still able to follow occupation as sailor. Had no other symptoms during failure of sight. Discs very white (blue white) on Y. S. side; nasal part of good colour. Central artery in R. much diminished; in L. less diminished.                                                                                                |
| 50  | Loose Notes. Alexander W. 23 when failure began. | 16 J. barely, at 10".<br>6 yrs.                | Failure began 6 yrs. ago. Now est. 30. V. has been stationary for 6 yrs. It reached present state about 6 mos. after it first began to fail. Note the want of perfect symmetry. | Moderate smoker.          | Continued to smoke throughout. | R. failed 2 or 3 weeks before L. It began as if a large drop of water was before the eye; this increased in size; also a floating musca before each. Was very weak and languid, and had severe indigestion at time failure began. Perhaps these symptoms due to masturbation. Thinks the indigestion was made worse by smoking. Health improved |

|    |                                               |                                                                                                                                                                                                        |                                                                                                                                                                               |                                                  |                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 51 | Private<br>1874.<br>Oct. 4.<br>Henry H.<br>54 | <sup>20</sup> / <sub>100</sub> .<br>12 mos.                                                                                                                                                            | V. deteriorated for the first 6 mos., and then remained stationary till he came to me. In this case improvement may have occurred later, but I have been unable to trace him. | $\frac{1}{2}$ oz. daily ..                       | Probably continued to smoke as before. | soon after failure of V. when he changed his occupation, and this would seem to throw doubt on the sexual system having had any influence on his sight. He was constipated at first, but not to an extreme degree. Discs rather pale; the L. universally, the R. only on Y. S. side. Failure of V. began at aet. 53, when he was laid up for 2-3 mos., from languor, weakness, and loss of appetite; these symptoms disappeared, but the amblyopia remained. Has been temperate as regards alcohol. Discs pale on Y. S. sides. |
| 52 | L. H.<br>H. 107.                              | V. failed after a prolonged attack of inflammation of eyes. Continued to fail for about 2 yrs., slowly. Then it slowly improved a little for a few years. Can now (17 yrs. after failure began) puzzle | ..                                                                                                                                                                            | $\frac{1}{2}$ oz. to 1 oz. daily, of "pig-tail." | Has continued to smoke throughout.     | The relation between the attack of inflammation, and commencement of failure, is uncertain. A healthy, robust man. No syphilis. On admission, 14 yrs. after failure, discs white, especially on Y. S. sides; slight notching of choroid at Y. S. side of each. Vessels not appreciated.                                                                                                                                                                                                                                        |



TABLE II.—*Cases which remained Stationary—continued.*

| No. | Re-<br>ference.<br>Age. | Vision when first<br>seen. Duration of<br>Amblyopia.                                                                                        | Vision at subsequent dates. | Habits as to Tobacco.        |                             | State of Health before Failure<br>of Sight began.<br>Sexual System. Mode of<br>Onset, &c. Patient's<br>Impressions as to Cause. |
|-----|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|------------------------------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------|
|     |                         |                                                                                                                                             |                             | Before coming<br>under care. | After coming under<br>care. |                                                                                                                                 |
|     |                         | zle out words of<br>14 J. When at its<br>worst could not<br>see his own fingers<br>held close to him.<br>Thinks L. rather<br>better than R. |                             |                              |                             | ably altered. 3 yrs. later,<br>discs the same, R. rather<br>paler than L. Arteries per-<br>haps slightly diminished.            |

TABLE III.—Cases which became Worse.

| No. | Re-<br>ference.<br>Age.  | Vision when first<br>seen. Duration of<br>Amblyopia. | Vision at subsequent dates.                                                                                                                                                                 | Habits as to Tobacco.                            |                                                                                           | State of Health before Failure<br>of Sight began.<br>Sexual System. Mode of<br>Onset, &c. Patient's<br>Impressions as to Cause.                                                                                                                                                                                                                                                                                                       |
|-----|--------------------------|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                          |                                                      |                                                                                                                                                                                             | Before coming<br>under care.                     | After coming under<br>care.                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 53  | L. H. R.<br>No. 38<br>45 | 16 J.<br>1 mo. or more.                              | In 5 mos. sight decidedly<br>worse. No later note.                                                                                                                                          | A heavy smok-<br>er. $\frac{1}{2}$ oz.<br>daily. | No note      ..      ..                                                                   | A cabman, tremulous with<br>drinking, and on verge of<br>delirium tremens. Had<br>been smoking and drinking<br>more than usual for some<br>months before V. failed.<br>Was at first very sleepy.<br>Appetite had long been<br>bad, and he had lived<br>mostly on beer. Discs at<br>first too red; 2 mos. later<br>"much whiter than natu-<br>ral." From the above<br>facts, it is very doubtful<br>whether he ever ceased<br>smoking. |
| 54  | O. H. R.<br>No. 24<br>28 | 20 J.; less than $\frac{20}{200}$ .<br>3 mos.        | In 3 mos. slightly worse =<br>20 J. barely. No later note.<br>In this case it is quite pro-<br>bable that improvement<br>would have taken place<br>later on, if he had left off<br>smoking. | $\frac{1}{4}$ oz. daily      ..                  | Continued to smoke<br>as before, during the<br>3 mos. that he re-<br>mained under notice. | V. failed suddenly whilst<br>exposed to hot sun one day<br>(sitting in the sun), but<br>continued to get worse<br>afterwards. A heavy<br>drinker of beer. Had great<br>difficulty in learning to                                                                                                                                                                                                                                      |

TABLE III.—Cases which became Worse—continued.

| No. | Re-<br>ference.<br>Age.  | Vision when first<br>seen, Duration of<br>Amblyopia. | Vision at subsequent dates.                                                                                                                                                                | Habits as to Tobacco.        |                                                                         | State of Health before Failure<br>of Sight began.<br>Sexual System. Mode of<br>Onset, &c. Patient's<br>Impressions as to Cause.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----|--------------------------|------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                          |                                                      |                                                                                                                                                                                            | Before coming<br>under care. | After coming under<br>care.                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 55  | O. H. R.<br>No. 18<br>48 | 20 J., $\frac{20}{0}$ .<br>5 wks.                    | In 1 mo. = letters of 16 J.<br>5 mos., the same.<br>6 mos., the same.<br>8 mos. V. = 16 J.<br>18 mos. $+ \frac{1}{12} = 8$ J.<br>In $4\frac{1}{2}$ yrs. much the same, or<br>rather worse. | $\frac{1}{2}$ oz. daily      | ..<br>Asserts that he quite<br>ceased smoking from<br>first attendance. | smoke. Discs very white ;<br>margins clear ; arteries<br>little, if at all diminished.<br>V. failed suddenly, while<br>walking in the street, not<br>in hot weather ; had diffi-<br>culty in finding his way<br>home ; did not get much<br>worse afterwards. There<br>had been no other symp-<br>toms. During the latter<br>part of his attendance he<br>complained much of eye-<br>ache ; it came in attacks,<br>lasting 2-3 wks. and then<br>passing off. Discs, on ad-<br>mission, thought to be<br>rather misty, but a week<br>later found to be decidedly<br>pale on Y. S. sides, and this<br>latter condition remained<br>unaltered at date of last<br>examination, 3 yrs. later ; |

the retinal vessels remained of good size. On admission, pupils acted well; no later note.

Failure quite gradual. When failure began he had some swimming in head, unsteadiness of gait, and slight numbness of hands, and also some diminution of sexual power. These symptoms all passed off, and his health improved as the sight became worse. Discs pale all over, but much more so on Y. S. sides. Central vessels somewhat diminished. Pupils very sluggish.

R. failed a short time before L. Discs very white, L. the whiter, and central vessels moderately diminished; no evidence of neuritis; no cupping.

Did not begin smoking till æt. 40; considerable difficulty in learning; has increased the quantity the last few years, and has observed that smoking, especially in the morning,

Continued to smoke for at least 12 mos. after failure began, and probably for longer.

$\frac{1}{4}$  oz. daily, about.

2 mos. later he wrote to say V. was worse.

Could just see a hand held before him. 12 mos.

M.C.T.  
No. 29  
35

56

Continued to smoke throughout, in spite of remonstrance.

$\frac{1}{2}$  oz. daily ..

3 mos after admission = the same.  
16 mos. after admission (nearly 2 yrs. from commencement of failure) bare p. l. Note the want of complete symmetry.

$\frac{2}{3}$  oz.  
5 mos.

M.C.T.  
No. 1  
37

57

Ceased smoking entirely 9 mos. after failure began.

Smoked only a little till 5-6 yrs. ago; since then  $\frac{1}{2}$  oz. daily.

2 mos. later, V. = 20 J.  
1 mo. later (about 12 mos. from failure beginning) = can barely find position of window.

In 9 mos. failed from newspaper type to No. 15.

O.H.R.  
No. 5  
60

85

TABLE III.—Cases which became Worse—continued.

| No. | Re-<br>ference.<br>Age. | Vision when first<br>seen. Duration of<br>Amblyopia. | Vision at subsequent dates.                                                                                                    | Habits as to Tobacco.        |                                                                    | State of Health before Failure<br>of Sight began.<br>Sexual System. Mode of<br>Onset, &c. Patient's<br>Impressions as to Cause.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----|-------------------------|------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|------------------------------|--------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                         |                                                      |                                                                                                                                | Before coming<br>under care. | After coming under<br>care.                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 59  | F. 269<br>62            | 16 J., $\frac{2}{3}$ . 5 mos.                        | 7 mos. after admission = 19 J.<br>2 yrs. = barely counts fingers<br>at 8".<br>$3\frac{1}{2}$ yrs. = cannot count fin-<br>gers. | Moderate smok-<br>er 40 yrs. | Ceased smoking en-<br>tirely about 10 mos.<br>after failure began. | often makes him nervous.<br>Is a bailiff, in comfortable<br>circumstances, and robust<br>and in apparently good<br>health. Has drunk mode-<br>rately of stimulants all his<br>life. Discs at first pale ;<br>became equally and univer-<br>sally white, and the arteries<br>somewhat diminished. Pu-<br>pils small, at first active,<br>but becoming motionless<br>afterwards.<br>Failure quite gradual. Thinks<br><i>L.</i> failed before <i>R.</i> No<br>other symptoms. A gar-<br>dener, in good health.<br>Takes alcohol moderately.<br>Discs at first pale on V.S.<br>side, the <i>L.</i> rather the<br>worse. They gradually be-<br>came paler, and the <i>R.</i> be-<br>came as atrophic as <i>L.</i> , or |



even more so. At last note, 4 yrs. after failure began, they were very white all over, but more so on Y.S. sides, and the central vessels scarcely, if at all, diminished. Complained of photophobia when all but blind.

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TABLE IV.—Cases which were Blind when first seen and, so far as is known, remained so *Permanently*.

| No. | Re-<br>ference.<br>Age. | Vision when first<br>seen. Duration of<br>Amblyopia.                                                               | Vision at subsequent dates. | Habits as to Tobacco.        |                             | State of Health before Failure<br>of Sight began.<br>Sexual System. Mode of<br>Onset, &c. Patient's<br>Impressions as to Cause.                                                                                                                             |
|-----|-------------------------|--------------------------------------------------------------------------------------------------------------------|-----------------------------|------------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                         |                                                                                                                    |                             | Before coming<br>under care. | After coming under<br>care. |                                                                                                                                                                                                                                                             |
| 60  | L.H.R.<br>No. 7<br>44   | Totally blind. Failed<br>in about 2 yrs.<br>The details of this<br>case are not as<br>complete as is<br>desirable. | 4 yrs. later = the same     | Moderate sm-<br>oker         | No note                     | In good health; steady ha-<br>bits; widower and father<br>of large family. Married<br>again after becoming blind.<br>Had syphilis in early life.                                                                                                            |
| 61  | L.H.R.<br>No. 10<br>45  | Became quite blind<br>in about 12 mos.                                                                             | ..                          | A smoker; no<br>details.     | No note                     | Failure began 6 mos. after<br>wife's death from phthisis.<br>Had had much trouble and<br>anxiety with her illness<br>and a large family. No<br>other special symptoms.<br>Pupils small, and dilated<br>oval and imperfectly.                                |
| 62  | M.C.T.<br>No. 32<br>50  | Failing for 2 yrs.                                                                                                 | Totally blind 3 mos...      | $\frac{1}{2}$ oz. daily      | No note                     | When failure began he had<br>sleepiness, giddiness and<br>profuse pyralism. The<br>pyralism continued up to<br>time of my seeing him,<br>2 yrs. later. A year before<br>V. failed he had changed<br>from being a car-driver in<br>Ireland to much more con- |

|    |                        |                                                          |                                                                                                                         |                                                                                                                               |                                             |                                                                                                                                                                                                                                                                                                 |
|----|------------------------|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 63 | O.H.R.<br>No. 27<br>40 | Failed 2½ yrs. ago;<br>as bad as now<br>for about 1½ yr. | Bare p. l. when seen, 2½ yrs.<br>after failure began.<br>Note his susceptibility to tobacco.                            | Very small<br>smoker; ⅓ or<br>⅔ oz. weekly.                                                                                   | Ceased smoking soon<br>after failure began. | Failure began suddenly on a<br>hot day in August, but<br>probably continued to get<br>worse for many months<br>afterwards; became worse<br>after he had ceased smoking.<br>Discs very white.<br>Learnt to smoke with<br>difficulty, and has always<br>been easily made sick by<br>over-smoking. |
| 64 | O.H.R.<br>No. 26<br>39 | Failure 2 yrs. . .                                       | V. shadows when seen 2 yrs.<br>after failure began. 4 yrs.<br>after admission (6 yrs. from<br>failure) V. rather worse. | ¼ oz. daily for a<br>year before admission; had<br>previously<br>used twice as<br>much. Lately<br>it has made<br>him nervous. | Never quite left off<br>smoking.            | Failure gradual; no other<br>symptoms. L. eye a little<br>worse than R. Pupils medium<br>size and motionless.<br>Discs very white; vessels<br>not diminished. Had much<br>difficulty in learning to<br>smoke.                                                                                   |

## MISCELLANEOUS CASES AND OBSERVATIONS.

BY JONATHAN HUTCHINSON, F.R.C.S.

(Continued from Page 60.)

CASE XC.—*Infantile Iritis leaving peculiar Opacities on or beneath Lens-Capsule—Deformed Teeth—Query: Small-Pox or Hereditary Syphilis.*

Louisa Pudney, æt. 6 (F. 289), was under care for phlyctenular ophthalmia in May, 1871. Atropine having been used, we found old posterior synechiæ in both eyes—two in the right and one in the left. At the point of attachment of each iritic tag to the lens-capsule there was a circular white spot. These spots of opacity in the right were as large as small pins' heads, the one in the left was larger, less regular, and surrounded by some less circumscribed opacity of lens substance. Probably these spots were anatomically similar to the ordinary pyramidal cataract occurring in ophthalmia neonatorum. Her central permanent incisors had been up for six months and were much malformed; the left was a mere peg, and when seen four years later was more like a little tusk; the right showed an irregular central notch and two nodular outgrowths from its front surface.

There seemed reason for attributing the changes in the eyes and the peculiar deformity of the teeth to an attack of "small-pox," from which the child suffered severely when two weeks old, her mother being ill, with the rash out on her, when the patient was born. The child's eyes were stated to have been closed by swelling for a month, and the specks were noticed as soon as she could open them.

The fallacy is as to hereditary syphilis. The mother herself appeared healthy and gave no history of syphilitic symptoms, but there were suspicious—though far from conclusive—facts

in the history of some of her younger children. They are best displayed in the following column:—

1. (f.) Living, 21; reported well.
2. (f.) Died, æt. 6, of "typhus fever."
3. (f.) Living, 15; reported well.
4. (f.) Living, 13.
5. (f.) *The patient*, 10 or 11 (in 1875 when last seen).
6. (m.) Living, 9; reported healthy.
7. (f.) Still-born.
8. (f.) Died, æt. 10 weeks, of "convulsions." No history of snuffles, rash, or thrush.
9. Living.
10. Living, æt. 4 months. Had thrush at bottom when æt. 2 months, but now shows no eruption or other suspicious appearances. (Examined carefully.)

There is no history of inflamed eyes or of deformed teeth in any of the other children, but I did not see any excepting the patient and the youngest. Her choroids were not examined.

CASE XCI.—*Fall on the Head, followed by Blindness with proptosis of one Eye and partial Deafness of same Ear. Death in twelve weeks.—No post-mortem—History of severe hæmorrhage shortly before Death and of Erysipelas of Head—Cause of Death uncertain—Query: Ruptured Orbital Aneurism.*

Richard M., æt. 45 (F. 106), an intemperate man, fell from a height of about 14 feet, striking, as he believes, on to his head and back. He was stunned, and did not remember anything for a week afterwards, but was told that he bled from the mouth, nose, and right ear; and both eyes were "black" when he regained consciousness. There was, he says, a wound on the right side of the scalp. Soon after the accident his right eye became prominent and very painful; he began to suffer from severe pain in the back of his head and became partially deaf of the right ear, and had a constant noise in it, like "someone stirring up water." He asserted that the prominence of the eye-ball was greater and the head-pain worse in the morning, and that the prominence diminished towards night. About five weeks after the accident he accidentally discovered that he could see nothing whatever with the right eye. He was an in-patient



at St. Bartholomew's, under Mr. Savory's care, for about seven weeks after the accident, and came to Moorfields on November 17th, 1870, two days after his discharge and eight weeks after the accident.

On admission at Moorfields there was great chemosis of the right conjunctiva; the eye was slightly prominent, and its movements somewhat limited, especially upwards. It was absolutely blind; the pupil was of the same size as its fellow, and acted well in sympathy with it, but did not act alone. The optic disc was pale, the veins very dilated and tortuous, the arteries small but quite distinguishable. He was partially deaf in the right ear, and was still suffering from severe pain in the back of the head and around the eyeball. Ten days later (November 28th) the pain was still the same.

Up to this date our diagnosis was uncertain, and doubt was felt as to whether an aneurism or a tumour might be present. Four years later, I learnt from his wife the following particulars.

On *December 24th* he died of "erysipelas" of the face and head. She said that there were no signs of swelling, &c., on *December 20th*, but that on the next day (21st) the symptoms began. His head became much swollen, the eye was "like a lump of blood," and it bled very much, so that the medical attendant had difficulty in stopping it, and said that "a vessel had broken." He had two fits, followed by paralysis of one side and loss of speech, and afterwards became delirious, and died on the 24th.

I believe that I only saw this patient once, and then hurriedly, and that the diagnosis was deferred. The account of the mode of death makes it very probable that an aneurism existed in the apex of the orbit, the rupture of which led to the swelling which was called erysipelas. As such the case seems worth record, though I much regret to give it so imperfectly, and without being able to add that the proper surgical treatment was carried out.

CASE XCII.—*Rupture of Sclerotic at front of Eye by a blow, with Extravasation (probably from Choroidal Vessels) by contre-coup, at region of Yellow Spot; subsequent Atrophy of Disc, probably from Rupture of Optic Nerve.*

Henry C., æt. 20 (F. 109), received a blow from a poker, five or six days before admission, on *November 10, 1870*. The swelling prevented him from opening the eye for several days, but when he could do so he found it blind. There was no pain.

On admission there was a laceration of the sclerotic at the inner and upper part; the cornea and iris were not damaged; the pupil was of ordinary size, but quite motionless; there was no perception of light, and with the ophthalmoscope an extravasation of blood was seen at the yellow-spot region, with evidence of sub-retinal effusion around it. A fortnight later (24th) the blood patch was more defined, its outline being roughly circular, though with some little irregularities. In the retina, over the surface of the blood were several minute brilliantly white dots, and one, rather larger than these, in the form of a white streak. The sub-retinal effusion was unaltered. On *January 2, 1871* (8 weeks after the accident), the blood had become almost completely absorbed, but the white dots remained as before. The disc was very white, and its outline somewhat unevenly curved, though not jagged or notched as if from neuritis; the retinal vessels of good size. The notes state that he now had perception of light, but whether this was the result of careful trial, or only of the patient's own assertion, is not stated. The cause of the disc atrophy is not clear, but rupture of the optic nerve behind the point where the central vessels entered it is the most probable event.

CASE XCIII.—*Extensive Choroiditis, probably congenital, and causing almost complete blindness—No other evidence of Hereditary Syphilis—Patient's father the subject of Retinal Hæmorrhage.*

(The case of the father of the following patient was published in Part I of the present vol., p. 48.)

Mary H., æt. 35 (F. 285), came to the hospital with her

father, in May, 1871, to know whether anything could be done for her sight. She could only see shadows, and her eyes oscillated so incessantly that a good ophthalmoscopic inspection was impossible. The optic discs were not seen, but there was abundant evidence of former choroiditis, pigment accumulations, and patches of exposed sclerotic. The pupils acted sluggishly. She said she had never been able to see better than she now could, and, according to her father's statement, the oscillation of the eyes was noticed as early as the age of 3 mos. Her father was not aware that she had had any illness in infancy, nor did he give any history of infantile syphilis. He denied syphilis in himself. The patient was the sixth of eight children; the first (m.) died at *æt.* 10 mos., of "convulsions," and the third (m.), at *æt.* 4 yrs. All the others were living. There had been one miscarriage. She was rather pale, with sandy hair and rather thick lips; her teeth were good, and she showed no signs of hereditary syphilis, excepting the choroidal disease. Catamenia regular.

CASE XCIV.—*Extensive Choroidal Atrophy in abruptly marked patches in an Infant—Extreme Convergent Strabismus—Nystagmus.*

Elizabeth S. (F. 313) was first brought to the hospital at the age of 9 mos., with the history that she had been noticed to squint since she was a month old. There was extreme convergence and constant lateral oscillation of the globes; the eyes looked small.

On *ophthalmoscopic examination* (under chloroform) it was thought that the refraction was myopic, but as the eyes oscillated this point was difficult to determine. There were patches of complete absorption of choroid to the temporal side of the right disc, while the choroid at the disc was jagged on the same side; in the left there was a large patch of absorbed choroid, with pigmented margin on the yellow-spot side of the disc. She could see large objects, but only by holding them very close to her eyes.

I again saw her four and a half years later (January, 1876), and found very large abruptly-margined patches of denuded sclerotic in both eyes. The margins of these patches were

irregular and map-like, with tags of pigmented choroid running into them like bands of adhesion in iritis; the patches themselves were quite clean, but their edges were pigmented; they were crossed by retinal vessels, and probably by large choroidal trunks. The retinal vessels were of good size, but the discs indistinct at their margins. This examination was made without chloroform, and it was difficult to be sure whether an increase had taken place since the former notes were made, or whether the former inspection had been incomplete. The child could now see fairly well; the squint was still present, but not nearly so marked; the eyes still oscillated.

She was in good health and intelligent, the second child. The eldest has good sight; the two youngest died at æt. 18 months of diarrhœa during delayed dentition, and there did not seem any reason to suspect hereditary syphilis in any of them. There was no family history of defective sight.

Although the appearances noted at the first examination in this case might possibly be accounted for by a high degree of congenital myopia, it seems probable that the more extensive disease made out at a subsequent occasion had really been present from the first, and that the case was one in which some form of choroiditis (perhaps intra-uterine) had occurred.

*CASE XCV.—Double Optic Neuritis during an illness with cerebral symptoms in a child—Recovery of perfect health with atrophied discs and great defect of sight—History of similar illness ending fatally in patient's only brother; his sisters healthy—Condition  $4\frac{1}{2}$  years after the Neuritis.*

Jas. J. A., æt. 9 (F. 92), was admitted on August 22nd, 1870, with well-marked neuritis in each eye; there were blood extravasations and effusion of opaque lymph.

A month previously he had been taken ill with severe pain in the head, worse in front and on the left side; he shivered. Soon afterwards he began to vomit and was sick repeatedly for a fortnight. The pain in the head lasted about a fortnight, and it was about a week after its commencement that he began to complain of bad sight. The left failed before the right. There was also much abdominal pain but no purging, and his abdomen

was described as being "flat" and not prominent. He lost much flesh. There was no deafness or affection of any other nerves, excepting that his mother said he squinted for a time. He never lost consciousness. The medical man considered it to be "gastric fever," but was unable to find any spots on the skin, though he is reported often to have looked for them. The child had had whooping cough, but no other children's complaint.

He was ordered (on August 22) 3 grain doses of iodide of potassium three times a-day in water. Two months and a half later (November 3) he was much better in health and had gained flesh; he could see 20 J. with each eye, and rather better with the left than the right (the exact state of vision on admission is not recorded). The discs were now pale, but still hazy at their margins, and the veins tortuous, especially in the right. He remained under care for a year, but his sight did not improve much more (18 J.).

I again saw him  $4\frac{1}{2}$  years after the above illness (February 1875). He was well grown and in good health; pupils active but rather large. With the left eye he made out letters of 16 J.; the right diverged and with it he could only count fingers at 1'. He had had good health since the above illness, though subject to occasional moderate headaches. The discs were bluish-white, their margins ragged and still slightly hazy, especially the left, and the choroid on the yellow-spot side slightly irregular. The arteries not much diminished, the veins perhaps rather more so.

It was stated that two years before the illness above described, he had been unwell with sickness and headache, and had lost flesh for a time. He is the youngest of four children; two (girls) are living, one (boy) died, æt. 5, of "gastric fever" after a few days' illness, accompanied by great pain in the head and sickness.



CASE XCLVI.—*Double Optic Neuritis ending in partial atrophy, but with great improvement of sight—History of failure of sight for a time some years before, and of several attacks of Hemiplegia—Sun-stroke? Syphilis?*

William P., æt. 58 (F. 108), came under care on October 24th, 1870, his sight being then with—

R. eye = 16 J;

L. eye = 18 J.

The discs were partially atrophied, and showed remains of neuritis, but I have no more detailed note until a month later (November 24), when the following observations were made. R., disc pale, remains of lymph at its margins, especially at the (real) upper and inner part, where a vessel is buried for a short distance in a patch of lymph; veins distended, arteries of fair size. L., disc paler than the R., slight remains of lymph at (real) inner part; yellow-spot side white and sharply defined, vessels as in the other eye. The latest note is on April 3, 1871 (four to five months after admission), when his sight had improved considerably and he could see 6 J. I have not been able to trace him since then.

He was a tall stout man, with a large head and somewhat amaurotic aspect: intelligence good, but he answered questions slowly. He had left off smoking a year before because it made him nervous and gave him headache. He had never had either rheumatic or scarlet fever. Nearly forty years before he had had a chancre, but there was no history of constitutional symptoms; he had a sore on his tongue ten years before I saw him, and the tongue was markedly fissured, but this slender evidence of tertiary syphilis was all that was forthcoming. He was married, and had five children living out of six. During the five or six years before I saw him he had had several attacks of cerebral symptoms. In the *first* he had pain at the back of his head, with some kind of "inflammation" of the eyes and failure of sight; he quite regained his sight after having been leeches at the back of the neck, but considered that he had remained weaker ever since. *Secondly*, five years before admission and shortly after the first illness, a partial paralysis of the right side occurred; he lost to some extent the power of remembering words; he was.

able to walk with help. This attack came on when he was sitting in a boat at sea in China, and exposed to a very hot sun. *Thirdly*, an attack of hemiplegia like the above took place three years later; and *fourthly*, another on the left side occurred in *July*, 1870, a few months before admission, and his left side had not quite recovered its strength when I saw him; sight probably failed about this time.

During the first month of his attendance he took two grain doses of iodide of potassium. He then complained of feeling very weak and nervous, and of being often shivery, and the iodide was changed for iron. His urine was tested and contained no albumen.

*CASE XCVII.—Failure of Left Eye from Neuritis, coming on a few days after an attack of slight Right Hemiplegia—Subsequent Improvement of Sight—Condition 4½ years after.*

Mrs. Anne C., æt. 31 (F. 107), came to Moorfields on November 21st, 1870, for defect of her left eye. The sight had failed four or five days previously, the failure being accompanied by severe pain in the head, around the orbit and “in the ball of the eye;” she also felt sick, but did not vomit. About ten days before the sight failed, or a fortnight previous to her admission at Moorfields, she suddenly one morning became somewhat weak on her right side, and had some numbness of the skin; she fancied her face was drawn to the left side; there was no loss of speech or memory. She went to St. Thomas’s Hospital, and was there told that she had had a slight paralytic attack.

*On admission:—*V. of L. eye = 16 J., and less than  $\frac{2}{10}$ .

R. eye = 1 J., and  $\frac{2}{10}$ .

In the left eye there was well-marked neuritis with abundant opaque effusion radiating from the disc, the veins dilated and tortuous, and hidden here and there by the lymph effusion; there were no hæmorrhages. I have no later notes excepting the patient’s statement in a letter written in reply to inquiry 4½ years later (May, 1875), that her “sight had been quite restored” under the treatment, which consisted of the bichloride of mercury in doses of one-sixteenth of a grain three times a-day.

There was in this case a strong family history of cerebral hæmorrhage. The patient's paternal grandfather died quite suddenly of "apoplexy;" and her own father and one of his sisters also died of similar attacks. The patient had never had rheumatic fever, and there was, on inquiry, no evidence of syphilis in herself or her children. She had scarlet fever at the age of eight, and had for long suffered from palpitation; I have no note that her heart was examined.

The symptoms in this case point in all probability to a cerebral hæmorrhage of small size on the left side. The relation of the neuritis to such a hæmorrhage in the present case admits of two interpretations, according as we suppose it either to be caused by the direct pressure of the blood on the optic nerve, or to be due to subsequent inflammatory change set up around or in the nerve by the presence of the foreign body. The latter explanation would account for the facts as above narrated better than the former, if we can rely on the woman's account that the pain and nausea, which probably indicated the commencement of the neuritis, did not begin till about ten days after the hemiplegia. A rupture of one of the early branches of the left anterior cerebral artery would probably supply a clot in the necessary position to explain the primary and secondary symptoms.

CASE XCVIII.—*Optic Neuritis of one Eye only, with severe pain on same side of Face—Atrophy of Disc, with Improvement of Sight—No Clue to Cause—Condition 5½ years later.*

Evan T., æt. 15 (F. 103), was attacked by severe pain in the right side of his face; he pointed to the infra-orbital region as the part affected. It lasted about a week, and was worse in the day-time than at night. He was not ill and had no sickness, but at about the time when the pain occurred he found that his right eye was "blind."

He came to Moorfields two or three months afterwards (November, 1870). The condition of the eyes was then as follows:—R., V. = 14 J. and  $\frac{20}{200}$ ; field of vision very much contracted; optic disc pale, its margin irregular, and choroidal rim disturbed and irregularly pigmented, especially on yellow-spot side; slight remains of lymph at (real) lower margin; vessels dimi-

nished, but not extremely so; refraction markedly hypermetropic. L., V. = 1 J. and  $\frac{2}{3}$ °. A medicine containing iron was prescribed.

Two months later (January, 1871), R., V. = 12 J.; pupil acts in sympathy with L., but scarcely at all alone; optic disc dirty white; veins and arteries much diminished.

A fortnight later, R. sees 10 J.

Three months after admission, R. sees some letters of 6 J.; there was no colour blindness; still considerable contraction of visual field. At the end of 6 months the right pupil had regained independent activity.

The boy appeared in good health; complexion fair, hair light brown. He had had measles and whooping cough, and six years before admission had had scarlet fever. He had not had rheumatic fever. There was no cardiac bruit. He stammered a little in speaking, and had always done so. There is no note as to acquired syphilis, but it is probable that I made the usual inquiries without finding any evidence of it. His father had died of "consumption;" mother living and in fair health. He showed no evidence of hereditary syphilis.

In April, 1876 ( $5\frac{1}{2}$  years after admission), sight remained the same, = 6 J. barely when held to the temporal side. The ophthalmoscopic state was much the same, the disc being now very white, but the vessels not more diminished than before, and being about half the size of those in the other eye; the veins were still markedly more tortuous than in the other eye, although much smaller than in it. It was now, however, found that there were several dots of black pigment scattered about the fundus, the largest being a little below the *fovea centralis*. They were roundish, but with lesser irregularities, and there was no evidence of atrophy of choroid either beneath them or at other parts; they were in all probability therefore indications of retinal hæmorrhages which occurred during the stage of neuritis.

CASE XCIX.—*A case of Neuro-Retinitis with abundant Retinal Hæmorrhages, in one Eye of a Woman suffering from Disease of the Liver and Piles. The notes extending over three years, and showing Relation of Final Condition to Appearances on Admission.*

Mrs. J. (G. 234) came under care at Moorfields on *January 2, 1873*. She was then *æt. 35*, a thin, flabby, pale woman, weakened probably by bleeding piles. About a week before admission she noticed a "speck" before her sight (both eyes being open). She had for years been subject to frequent frontal headache—"shooting" pain, and this had, she thought, been worse of late and more confined to the left side than usual. Since childhood she had been partially deaf of the left ear from an abscess. She had for a year past been feeling very weak and unable to eat well.

On admission:—V. R. 1 J. and  $\frac{2}{7}\frac{0}{0}$ .

L. 16 J. and less than  $\frac{2}{8}\frac{0}{0}$ .

Ophthalmoscopic examination — L., Optic disc very much swollen, veins tortuous and dilated, and hidden in places by opaque white lymph; numerous extravasations. For a month she took iodide of potassium, but subsequently iron and quinine.

Four-and-a-half months after admission (*May 15th*) the white lymph had become partly absorbed; there were still numerous hæmorrhages about the optic disc and yellow spot; those near the optic disc were splashy or flame-shaped, and were beginning to fade; those at the yellow spot were punctate. She was trembling and weak, and said she had had much headache ever since the eye failed. In  $6\frac{1}{2}$  months (*July 17th*) the hæmorrhages were beginning to be replaced by pigment spots, especially at the yellow spot. She continued attending regularly and taking the ferruginous mixture for nearly two years (*November, 1874*); the sight of the left eye had then become rather worse, only letters of 20 J. being read. In *January and February, 1875*, she was very ill with symptoms of liver disease (hæmatemesis followed by jaundice), and I did not see her again until *February, 1876*, when she attended at request, and I again examined the eye. I regret that I have no note as to her urine.

At that date, three years after the neuro-retinitis, V. of L. eye = as before, barely letters of 20 J. The optic disc is of good



colour, not atrophied, the vessels still tortuous, especially the main artery passing (really) downwards, which is much more tortuous than its companion vein, and is partly obscured by opacity at one part. There are still the remains of extravasations in the form of two or three little red patches radiating outwards from the (real) upper-inner part of the optic disc. At the yellow spot is a large patch of choroid, from which the pigment epithelium has been removed, or rather has become heaped up into several little coal-black spots scattered over the denuded area.

CASE C.—*Neuro-Retinitis with Hæmorrhages and Amaurosis in one Eye; signs of similar past disease with implication of Choroid near Yellow Spot in other Eye*—Patient a girl of 17, healthy but delicate—No other symptoms whatever—Recovery of nearly perfect sight, with defective visual field and pale Disc in the second Eye; the Eye first affected remaining nearly stationary—Condition at end of  $2\frac{1}{2}$  years.

Mary Anne C., a servant girl, æt. 17 (F. 116), came to the Hospital in November, 1870, saying that her sight had failed gradually for a month, having been, as she believed, perfect until then.

V. of R. = 6 J. barely,

L. = Can see the hand, but cannot count fingers.

*Ophthalmoscopic examination.* In the right a large patch of atrophied choroid, with abundant pigment on its surface, and exposed sclerotic behind it, was seen near the yellow spot. (There is no description of the optic disc at this date, but some months afterwards the retina around it was slightly hazy and the disc itself two years and a half later was somewhat pale; it is probable therefore that this eye had some months before we saw the patient gone through a condition of neuro-retinitis something like that found in the left on admission, the defect of sight not having been noticed by her until the failure of the left occurred.) *Left.* Profuse neuro-retinitis; optic disc hidden by lymph which extended as far as the yellow spot, and buried the arteries and veins at many places both on the disc and at some little distance from it; veins dilated and tortuous, and several small extravasations present in the retina. A few days later a well-marked group of bright white spots was present in the retina at

the yellow spot. In a fortnight (*December 15*) the lymph on and about the disc had increased; the *fovea centralis* appeared as a red spot in the centre of an area of opaque white retina, on which were several of the white dots above mentioned.

Two and a half months after admission (*February 9, 1871*) the lymph at the left disc was clearing off, and there were now only three or four very small white dots in the region of the yellow spot. She said she could see rather better.

At the end of four and a half months (*April 6*) she could read 1 J. with difficulty with this eye; disc pale, veins full, some lymph still remaining at the (real) upper edge of disc, yellow spot region showing no evidence of disease at all. It is also noted that the R. appeared to have improved, for she could now manage to make out 1 J. with it.

In *March, 1873* (nearly two and a half years after her first attendance), she came again for a slight ophthalmia of the left eye. The conditions were much as at the last note. *Left eye.* V. = 1 J. with difficulty, and its visual field defective at inner and lower part; optic disc pale and its tissue hazy, some lymph still extending from its (real) upper and outer edge for a short distance into the retina; arteries rather small, veins normal. *Right eye,* optic disc somewhat pale and veins rather full, in other respects as on admission.

The patient was a well-grown, healthy looking, though rather delicate girl, with good features, and on the closest inquiry I could not make out that she had had a single symptom of bad health of any kind in connexion with the failure of sight. In early childhood, as she believed, she had had scarlet fever, but it was not followed by dropsy. Her urine was examined twice; it contained on one occasion a doubtful trace of albumen, but none the next time; both specimens showed a fair number of very long, exceedingly faint cast-like bodies, the size of which varied in different parts, and which were more like strings of mucus than renal casts. The heart's action was rather heaving, and irregular in rapidity, but there was no bruit. She had never had rheumatic fever. She had menstruated regularly for four months before she came to the Hospital, having previously been unwell a few times at uncertain intervals. There was a history of consumption in the family, and she herself showed a large deep scar on the right neck from an abscess at the age of 11.

Her skin was fine and soft, but this was the only fact in the least suggestive of hereditary syphilis, and the account given of her brothers and sisters was quite negative in this respect. There seemed no reason to suspect her of the acquired disease. I am sorry that I have omitted to record the treatment, but have no doubt that it consisted in the administration of the iodide of potassium in moderate doses, perhaps with small quantities of mercury.

CASE CI.—*Choroiditis or (?) Retinitis causing very numerous separate small deposits in region of Yellow Spot and Optic Disc in one Eye only—Symptoms setting in with a feverish attack near menstrual period—Hereditary Syphilis suspected, but no other evidences of it—Recovery of nearly perfect sight and absorption of the deposits.*

Miss T., æt. nearly 14, became my patient in January, 1873, for defect of her left eye, dependent on the presence of very numerous small punctate deposits in the choroid or in the deep layers of the retina. They occupied the whole yellow-spot region, and also formed a wide but irregular belt almost entirely surrounding the optic disc. At the yellow spot they were smaller and also more closely set than elsewhere, and formed a dense constellation of very small white dots. Those around the optic disc, and away from the yellow spot, were larger and less crowded, but few even of these were wider than the largest retinal vessels; almost all of them were discrete; but there were two or three little patches formed by the confluence of two of the spots. They were circular, and their colour varied from yellowish to bright white; most of them indeed showing both tints, the border being yellowish and shading off gradually, while the centre was more intensely white; there were many, however, which were not much whiter at the centre, while a few were merely minute white specks without any surrounding yellow base. The whitest of all were those close to the *fovea centralis*, while the deposits forming the border of the yellow spot constellation were much less white. None of them were in the slightest degree pigmented. There was no haze of retina or disc, nor were the retinal vessels altered in size. She complained

of a central defect in the field of vision, and could see 40 Sn. at 6'.

The failure of sight had come on between two and three months before I saw her, and in connexion with a slight feverish attack; there was at first some feeling of fullness and aching in the eye and over the brow, *muscæ* and photophobia. A few days after the failure of sight she menstruated.

There seemed reason to think that she inherited syphilis from her father, and I therefore prescribed iodide of potassium. On *March* 6 (nearly 2 months after I first saw her) the deposits were less bright and glistening than they had been, and her sight had improved a little. Subsequently under the continued use of the iodide they wholly disappeared, and almost perfect sight was restored. The other eye was never affected in the least.

This young lady was in apparently excellent health, and had never in her life had any serious illness, having escaped scarlet fever, measles, and whooping cough. She began to menstruate before she was 13, but had not done so regularly. Six weeks before her sight failed she had a feverish attack, following a day or two after menstruation, but soon subsiding; it was attended with severe headache and great heat of skin for a day or so. A second and precisely similar attack occurred, as already mentioned, the day before she noticed the failure of sight, but this time menstruation had not preceded it, and did not occur till a week later. A third attack took place six weeks after the second, and again a week before menstruation. She showed no signs whatever of hereditary syphilis, nor had she had any infantile symptoms; and I should not have suspected it, had not her father voluntarily told me that he had suffered from primary and secondary syphilis nearly ten years before the birth of the patient, and that he had since her birth had *psoriasis palmaris*. Neither the patient nor any of the other children had any infantile symptoms, excepting an eruption of doubtful character in a child several years her junior. There seems therefore but very little reason for looking upon the patient's eye symptoms as syphilitic. Her other eye remained healthy throughout.

In comparing this case with the preceding one, it must be noted that Miss ——— did not come under my notice until ten or eleven weeks after the failure of sight began, and that she had

taken mercury to slight salivation for the first six weeks, and small doses of iodide of potassium from the date of failure. My own treatment, therefore, consisted simply in continuing the iodide. It is reasonable to infer that these vigorous measures prevented the disease from ever reaching its highest degree of severity, and that it might if unchecked have implicated the superficial layers of the retina and the optic disc. A portrait of the fundus of the eye was made for me by Mr. Burgess, and was shown at the London meeting of the British Medical Association.

With regard to the exact seat of the deposits in this case we cannot be positive; the fact that they entirely disappeared without leaving any visible disturbance of the choroido-retinal epithelium, and without causing absorption of choroidal tissue, would seem to point to the deeper layers of the retina as their most probable seat. But their diffuse yellowish base, apparently continuous with the choroid, is against this view; and again, it is not easy to understand how deposits so numerous as these were, and lasting so long as they did, could implicate the perceptive elements of the retina, and yet allow of almost perfect restoration of sight.

CASE CII.—*Neuro-Retinitis with great changes at Yellow Spot in one Eye of a healthy lad, without apparent cause.*

Henry B., æt. 17, was admitted at Moorfields in December, 1875, complaining of his left eye. Three weeks before admission he began to notice "stars" when looking at print by gaslight; this symptom increased, and he soon found it was due to defect of his left eye. He thought that the right had also begun to fail a few days before admission, but the defect, a slight one, passed off shortly after treatment was begun, and there were never any positive ophthalmoscopic changes.

In the *left* eye the optic disc was slightly hazy over its whole surface, one or two of the large vessels were partly obscured, the retinal vein running downwards was notably distended. The yellow-spot region was entirely occupied by a greyish-white patch, nearly homogeneous in appearance, and giving off from its borders some faint and ill marked spurs or processes; near its centre were a few minute glistening white



dots; the retina surrounding the dense patch had an indistinctly stippled appearance, but was scarcely hazy. Six weeks later (*February* 10, 1876) the patch at the yellow spot was more abruptly defined, somewhat less white and more patchy, and a few dots of pigment were to be seen on its surface; the spur-like processes had become more definite, and brought to mind by their appearance the spurs projecting from a patch of scarkeloid. The patient is still under care, and I cannot yet state the final result.

He is a compositor, in good health, and has had no symptoms of ill health whatever, excepting the failure of his sight; there has been no headache and no sickness. No evidences of acquired syphilis were present, and I examined his person thoroughly; he, however, admitted having on a single occasion, about eight months before, been exposed to risk of contagion. There was nothing suggestive of hereditary taint in his features and teeth, nor in the history which he gave of his brothers and sisters. He believes that he had scarlet fever in childhood, but has never had rheumatism of any kind. His urine has been tested more than once, and found to be free from albumen and sugar.

CASE CIII.—*Neuro-Retinitis, symmetrical, and resembling that from Kidney Disease—History of repeated Headaches and Sickness—No Albuminuria—Patient a girl of 12.*

Annie B., æt. 12 (G. 97.), was sent to me from the Hackney Orphanage, in July, 1872. She could then just distinguish shadows, the pupils acted fairly. The optic disc in each eye was milky-white and hazy, the haze extending into the surrounding retina, especially towards the yellow-spot region; there were a number of white dots in the retina as in cases of renal retinitis, and in the retina there were some cicatricial looking lines. The retinal vessels were of normal size. Her urine contained neither albumen nor sugar.

The history was, that about seven or eight months before I saw her she had become liable to severe headaches, lasting, perhaps, a day, and then ceasing entirely for several days, during which intervals she would be quite well again. On one occasion she fainted from the severity of the pain and

she was often violently sick. The headaches and vomiting continued, with intervals of several days during which she would play about as usual, for three or four months, and then her sight began to fail. The failure was symmetrical, and progressed rather quickly, so that for two months before I saw her she had been unable to read. The headaches were not accompanied by either sleepiness or special restlessness.

Beyond the facts that she had been in the Orphanage for six years, had had excellent health till the above symptoms began, and that she showed no evidence of hereditary syphilis, I have nothing to add to the above incomplete record. I learnt that she afterwards left the Orphanage and was lost sight of, but whether she regained her sight I do not know.

The case was not improbably one of incipient cerebral tumour, but I place it in the present series as one in which no cause was proved for a well pronounced neuro-retinitis occurring in a child near the age of puberty.

## PATHOLOGICAL AND CLINICAL NOTES.

BY EDWARD NETTLESHIP, F.R.C.S.

*Surgeon to the South London Ophthalmic Hospital.*

*Optic Neuritis in an Eye lost by Ophthalmia Neonatorum.*

In examining the eye of an infant, aged 3 months, excised for prominent corneal staphyloma, following purulent ophthalmia, I found the optic disc considerably swollen and forming quite a prominent little hillock when looked at with the unaided eye. I unfortunately did not notice the state of the disc until after the eye had been hardened in spirit, and therefore cannot say positively whether the swelling was accompanied by opacity or not. As, however, the eye had been opened while fresh, and the condition of the vitreous, &c., noted, it is probable that any considerable opacity of the disc would have attracted attention, though a moderate degree of swelling, without much haze, might escape notice unless specially looked for.

Microscopical examination of the hardened optic disc showed that the absolute thickness of its tissue was not much greater than that of an adult healthy disc, the measurement in each case being taken at right angles to the choroidal margin of the disc; but the relation between the thickness of the disc substance measured in this way and the width of the choroidal ring was very different in the two cases. Thus in a section, in the horizontal meridian, of a healthy adult disc, I find that the thickness of the disc substance is equal to about one fourth of the width of the choroidal ring (1 to 4), while the proportions of these parts in the specimen here described are as 1 to 2, the section being in the same direction. The swelling chiefly affected the deepest part of the disc, just within the choroidal ring, and had, as usual, caused displacement of the retinal elements from the margin of the disc, the granule layers in particular being crowded up and distorted; there was also a slight heaping up of the retinal pigment epithelium due to the same cause. The

nerve fibres of the disc had, to a great extent, lost their parallel arrangement, being distorted so as to form an irregular network with narrow, oval, or roundish spaces. This change was probably due to the so-called varicose swellings of the nerve fibres, but the number of these swellings observed in teased specimens did not account for all the changes seen, and perhaps separation of the fibres by serous fluid would explain the remainder. There was not the slightest increase of nuclei in the disc.

There were no striking changes in the retina and choroid. The bacillar layer of the retina was, however, ill-defined and too thin, and its separate elements seemed fused together; this appearance was probably due to atrophy after a previous state of oedema.

There was also a well marked anterior polar cataract and anterior synechia. The opacity forming the cataract was beneath the capsule; it consisted of tissue resembling fibrous tissue when seen under low powers, but its apparent cells and nuclei were however usually resolved into oval spaces, and the apparently fibrous matrix into altered and distorted lens-fibres, when more highly magnified. The capsule over it was much puckered, but the degree of the pyramidal prominence of the whole opacity very slight.

This specimen is of interest in connexion with defects of sight caused by ophthalmia neonatorum. These are, I believe, sometimes greater than would be expected from the state of the cornea, and it may be that a greater or less degree of neuritis or neuro-retinitis is not uncommon during the acute stage, when the tissues of the front of the eyeball and of the lids are highly inflamed. It is possible that the inflammation in some cases travels backwards, and affects the deep structures of the orbit, as occasionally happens in erysipelas; or that all the tissues of the eye are involved in the inflammation, as in traumatic and other forms of ophthalmitis. In the specimen here described probably the latter is the more likely explanation. Congenital syphilis may also have been the cause, and I regret that I did not exclude it.

A case of atrophy with evidences of former neuritis in a patient who had had purulent ophthalmia in infancy, is mentioned by Mr. Hutchinson, in vol. vi, p. 140, of these Reports.

*Destructive plastic Irido-Cyclitis with implication of Vitreous, Retina and Choroid. Much new tissue formed in Ciliary Region. Patient a young man. Syphilis suspected, but no other evidence of it found.*

Henry D., æt. 19, was admitted at Moorfields, on March 25, 1872, under Mr. Hutchinson's care, on account of what was diagnosed as phlyctenular ophthalmia of his right eye. No very active treatment was used. Ten days later (April 4) there was well-marked kerato-iritis, ciliary congestion, haze of cornea, and several posterior synechiæ. There was very little pain. There was no history of syphilis; for a few days there was a small superficial sore, probably due to retained secretion, at the reflection of the prepuce, and he had a fistula near the anus; but these were the only facts in the history of the case from beginning to end which gave the least support to the supposition that his eye disease was syphilitic.

Iodide of potassium, blisters, and atropine were prescribed. On April 8, it was noted that there was a "vascular elevation at the periphery of the iris," and on the 11th this nodule was larger, but under the use of atropine the pupil had become nearly round. Mercury was now ordered, and the iodide increased, under the idea that the disease was in some unexplained way of syphilitic nature. The nodule however continued to grow, and to become paler, and the patient ultimately being dissatisfied attended on another day, and became Mr. Couper's patient. I believe that the same diagnosis was made; mercury was certainly continued. The eye however became steadily worse, until a considerable staphyloma-like bulging formed in the ciliary region in continuity with the large yellowish nodule occupying the anterior chamber. He lost flesh and became very pale and weak under the use of mercury. On May 10, the eye being evidently lost, Mr. Couper excised it. I saw the patient again in the middle of June, but again failed to find on him any signs of syphilis. The other eye did not suffer.

Examination of the eye. Immediately after excision T. much diminished. Put into Müller's fluid for six months, when it was found that the sclerotic was not well hardened, being much



less hard than the sclerotic of another eye which had been excised at the same date and kept in the same bottle.

On opening the globe by an antero-posterior section the staphylomatous bulging was found to be a solid mass of new tissue. The vitreous was semi-opaque and softly gelatinous, while near to the mass in the ciliary region it became yellow, opaque, and stringy. It separated very easily from the retina everywhere excepting in front. Its central parts contained a moderate abundance of scattered corpuscles, for the most part in process of development into connective tissue (oval and spindle-cell stage); while on its outer surface, especially at the hinder part of the eye, these corpuscles were more abundant, and were mingled with much albuminous substance in the form of the hyaline globules so commonly seen in inflamed eyes which have been preserved in Müller's fluid. The stringy tough portions near the ciliary growth consisted largely of peculiar, highly refracting fibres thickly felted together in all directions, and apparently unconnected with the corpuscles which lay entangled in their meshes. These fibres may have been altered fibrinous effusion. The *Retina* and *Choroid* were both evidently thickened, especially at the back of the eye; with the exception of a number of slight foldings of the retina, these tunics were *in situ*. The thickening of the choroid was caused partly by œdema of its deeper layer, partly by diffuse infiltration of new corpuscles, chiefly into the chorio-capillaris. Between the choroidal epithelium and the retina was a thin layer of structureless coagulated effusion. The bacillar layer of the retina was much thickened near the disc by elongation of its elements, but at the yellow-spot region the rods and cones were not noticeably altered. The other layers of the retina were all somewhat thickened near the disc, and the disc itself a little swollen. In the sheath of the central vessels, and still more in the sheaths of the retinal branches, were large numbers of closely packed, small, round cells. This change did not extend further back than the lamina cribrosa, or at most only in a slight and doubtful degree, and it was much more marked close to the surface of the disc than deep in its substance; the collection of cells surrounding the retinal branches often exceeded in thickness the lumen of the vessel. The nuclei of the fibrous septa above the lamina cribrosa were greatly increased in number, but behind it they were unaltered.

The growth in the ciliary region was a solid mass of tissue, consisting mainly of round cells, but with many strands of elongated cells and fine fibres (granulation tissue). It had displaced the lens, converted the corresponding part of the iris into a mass which quite filled the anterior chamber, had burst through the eyeball at the sclero-corneal junction, and grown into a prominent mass outside. The line of rupture was shown by the pigment of the ciliary processes which was invaginated into it. There were many loops of large vessels in the extra-ocular part of the growth, and a certain number also in the intra-ocular portions. The cornea was quite separated, its edge at the line of rupture simply lying in contact with the growth but being quite loose. This loose edge was much thinned, and consisted mainly of cells closely packed; it contained vessels obliterated towards its free edge, and becoming much larger somewhat further from the border; these appearances no doubt showed that the ruptured corneal edge, which had previously been very vascular, was now on the point of sloughing. Somewhat further from the border the cornea was thickly infiltrated with layers of cells in its deeper parts, the superficial strata being free. The anterior epithelium was quite wanting in the sections. The ciliary processes and ciliary retina were enormously thickened, and formed part of the growth, and there was also much new growth, in the form of more or less isolated collections of cells, between the elastic lamina and the ciliary muscle towards the posterior part (not very far from the ora serrata); there were no such collections of cells in the corresponding position at the anterior part of the ciliary muscle. The tissue of the muscle itself was much less affected, though it showed a considerable number of scattered new cells arranged between its bundles; the deep layers of sclerotic lying over it were free from change, though the layers nearer to the outer surface were continuous in structure with the growth. This comparative exemption of the ciliary muscle from inflammation affecting the parts immediately beneath and in front of it was very striking.

A case very similar to the above was recorded in vol. vii, p. 360, of these Reports. The patient was a boy, *æt.* 11, without evidence of syphilis either acquired or inherited,

and no satisfactory cause was found. The pathological changes were almost identical with those in the present case.

Another specimen in which the condition was undoubtedly due to secondary syphilis, and had begun as iritis, is given at p. 370 of the same vol. A third case, at p. 580, of destructive irido-cyclitis, with much new tissue in the ciliary region, may also be compared with the others here quoted; the patient, æt.  $2\frac{1}{4}$ , was very probably the subject of hereditary syphilis.

#### SOME CASES OF VARIATIONS OF THE RETINAL BLOOD-VESSELS.

##### I.—*Retino-Choroidal Anastomoses.*

A short time ago I recorded\* some cases, with diagrams of the optic discs, in which there was ophthalmoscopic evidence of anastomosis between the retinal and choroidal blood-vessels at the disc. I had then seen only three cases, but two others which came to notice while the communication was in the press were mentioned. The following are the details of these two cases, and of two others which have more recently been observed, making seven in all. In each case the vessels are described as if seen in the erect image.

CASE I. Miss A. S., æt. 30. Her *right* eye is myopic  $\frac{1}{11}$ . There is a narrow crescent on the yellow-spot side of the disc. A retinal vein of the fourth or fifth magnitude passes from slightly below the yellow spot inwards, over the crescent and on to the disc for a short distance; it then curves upwards and outwards, recrossing the area of the crescent, and disappears under the abruptly defined choroidal edge of the latter; whilst on the area of the crescent the vessel is crossed, after leaving the disc, by a little linear patch of pigment. Her *left* eye is myopic  $\frac{1}{24}$ , but there is no crescent. A vein of about the same size as in the other eye passes from above the yellow spot, inwards and slightly upwards, makes a large sweeping curve downwards and outwards on the disc, and disappears abruptly under the choroidal rim, just at the horizontal meridian.

\* British Medical Journal, Feb. 5, 1876.

In each eye the central vessels branch rather more freely than usual whilst on the disc, but none of these branches pass over the yellow-spot portion of the disc on which the erratic vessels above described take their course. The lenses are partially cataractous, but not enough to prevent an almost perfect view of the details of the fundus.

CASE II. Ellen S., æt. 35, Mr. Hutchinson's patient for atrophy of the right disc (G. p. 398). In this eye a small vein runs from rather below the yellow spot, and on reaching the disc turns abruptly downwards immediately within its choroidal boundary. It makes only a very small curve, but enough to show that it probably bends back beneath the choroidal edge, and does not dip down vertically into the optic nerve. The central vessels are of good size, and all the details of the disc can be seen with perfect distinctness by the direct method. The atrophy of disc was watched from the first, and there never was any intra-ocular neuritis.

CASE III. Jas. H., Mr. Hutchinson's patient (J. p. 85) for tobacco amaurosis. In his left eye a small vein (about the sixth size) coming from below the yellow spot curves back after reaching the disc, and disappears in the choroid in the manner described in the previous cases. The eye is hypermetropic, but the disc is bordered by a very narrow crescent of partly exposed sclerotic. There is a similar crescent, but no corresponding vessel, in the other eye.

CASE IV. Wm. A., æt. 19, Mr. Hutchinson's patient. He is highly myopic (about  $\frac{1}{2}$ ) in each eye, but his sight is very defective from atrophy of the discs; the cause of the atrophy is very doubtful, but there is no evidence that it was preceded by neuritis; the retinal vessels are scarcely if at all diminished. The *right* disc is nearly surrounded by a narrow crescent of varying width in different parts. A small vessel (probably a vein, but on this point I could not be positive) passing from rather above the yellow-spot region, gains the surface of the disc, on which it makes a bold curve downwards and again outwards, passes over the area of the crescent (here very narrow), and disappears under its choroidal boundary. In the *left* the disc is entirely surrounded by a narrow ring of exposed sclerotic. A vessel (again probably a vein) runs inwards from a little above the yellow spot, curves downwards

and again outwards, forming a good loop, and disappears at the scleral edge of the disc; in this case it cannot be traced clearly over the atrophic area, but seems to run outwards into the sclerotic instead of into the choroid. Another vessel of the same size dips vertically into the disc, rather near its edge, but shows no sign of bending back towards the sclerotic.

II. *Unusually Tortuous Retinal Arteries ; no disease of Eyes, but a high degree of Hypermetropia.*

CASE I. Lucy H., æt. 17. She believes her left eye has been always defective. She felt no inconvenience from the right until about two months before she came for advice. Probably the failure was due to over straining the accommodation in working for an examination, but she did not admit having felt tired. Pupils rather large and sluggish.

V. 6 J. for a short time  $\left\{ \begin{array}{l} \text{R. } \frac{20}{40} \text{ badly ; Hm. } \frac{1}{15} \text{ but not improved.} \\ \text{L. } \frac{20}{100} ; \text{Hm. } \frac{1}{8} = \frac{20}{70}. \end{array} \right.$

After the use of atropine for a week,

V.  $\left\{ \begin{array}{l} \text{R. } \frac{20}{200} ; \text{H. } \frac{1}{6} = \frac{20}{60} ; + \frac{1}{6} \text{ s. } \ominus - \frac{1}{18} \text{ c} = \frac{20}{40}. \\ \text{L. } \frac{20}{60} ; \text{H. } \frac{1}{2\frac{1}{2}} = \frac{20}{70} ; \text{no improvement by cylinders.} \end{array} \right.$

Ophthalmoscopic examination. In each eye the arteries are extremely tortuous, while the veins are but slightly more so than in ordinary eyes. The tortuosity is especially marked in the arteries passing outwards above and below the yellow spot, and it reaches its maximum in a large branch passing downwards and outwards in the left eye. It is most remarkable in degree, some of the vessels making several acute and large S bends; it affects the small arterial twigs running directly outwards to the yellow spot as well as the large branches skirting that region. At some of the bends the arteries become much less distinct, as if they dipped into the retina, or as if the retina itself were folded at those parts; there is also a very slight haziness at the edge of the disc, just at the parts where vessels cross it, but nowhere else. At one examination it was noted that there was slight pulsation both in the arteries and veins.

The patient was an undergrown girl, with florid rather patchy cheeks, as if from sluggish circulation. She seemed in good



health, and was working as a pupil teacher. She has been examined repeatedly by many observers, and the condition of the arteries has remained the same throughout many months. The sight is the same as on admission, but with glasses she is able to work better than before. The defect of the left eye is probably to be explained by the higher degree of hypermetropia present in this eye than in the other. There is no evidence of heart disease.

CASE II. Minnie W., æt. 11., a very healthy, well grown, pretty child.

V.  $\left\{ \begin{array}{l} \text{R. 6 J.} \\ \text{L. 10 J.} \end{array} \right\}$  held close  $\left\{ \begin{array}{l} \text{and } \frac{20}{0}; \text{ Hm. } \frac{1}{30}, \text{ but not improved.} \\ \text{and } \frac{20}{0}; \text{ Hm. } \frac{1}{10}, \text{ but not improved.} \end{array} \right.$

After the use of atropine for a fortnight, glasses being tried more than once during that time, I found

V.  $\left\{ \begin{array}{l} \text{R. } \frac{20}{0}; + \frac{1}{5} \text{ s. } \ominus - 18 \text{ c.} = \frac{20}{0}, \text{ slowly but perfectly.} \\ \text{L. } \frac{20}{0}; + \frac{1}{5} \text{ or } \frac{1}{6} \text{ s. } \ominus - 18 \text{ or } 14 \text{ c.} = \frac{20}{0} \text{ only.} \end{array} \right.$

The great defect of the left is scarcely explained by its slightly higher degree of hypermetropia.

Ophthalmoscopic examination showed no disease in either eye, but a very tortuous condition of the retinal arteries. The most tortuous branches were those passing outwards above and below the region of the yellow spot, and this condition extended for a long distance. At the bends, the vessels often became less distinct, as if they dipped into the retina or as if the retina were folded. The tortuosity was somewhat more marked in the left eye than in the right, a fact which I noticed quite independently of the greater defect in this eye. The veins were not more tortuous than usual. The discs were perfectly clear; there was no suspicion of haze as in the former case. The tortuosity of the arteries, although a very marked feature, was not so extreme as in Case I.

*Two remarkable cases of Choroido-retinal disease in Children, without assignable cause.*

CASE I. Eliza R., æt. 12, was sent to me in December, 1874, at the South London Ophthalmic Hospital, because she had lately found that she could not see with her right eye. I found that with it she could barely see shadows; the eye

sometimes diverged, and there was slight epiphora; the pupil acted in conjunction with its fellow, but not alone. With the left she read 1 J. at from 6" to 16" distance and the fundus was healthy.

The ophthalmoscopic examination of the right (the pupil being dilated with atropine) disclosed unusual and most extensive changes in the retina and choroid. At the periphery in many parts were large patches of absorbed choroid, with much pigment accumulation on them. In the more central parts there were very large areas of white deposit with diffused (misty or woolly) borders, and quite different in appearance from the atrophic patches. The disc was entirely surrounded by one of these large areas of deposit. In some cases there was pigment on the deposits or at their borders. The retinal vessels were often seen to run unobscured over the white patches, and were nowhere seen to be hidden; the deposits were therefore for the most part, if not wholly, sub-retinal. Near to the yellow spot there were two large patches of dark red blood, one of them in contact with a large retinal vein, and both of them adjoining the margin of one of the areas of white deposit; there was also a patch of pigment obscuring a retinal vessel of about the fourth size near the yellow spot. The disc itself was of a peculiar grey colour, but the retinal vessels were not diminished in the least. At the lower and outer part of the periphery the retina was detached over a considerable area, so as to quite obscure the choroid.

In addition to the above remarkable changes, there were abundant glistening scales of cholesterine scattered about on the retina or on the choroid; some of them were on the white deposits, others overlay portions of apparently healthy choroid; they were all fixed, and although there was apparently some diffuse haze of the vitreous I could not see in it any moving crystals of cholesterine.

The girl appeared to be in perfect health, and was very well-grown. For about a year past she had been subject to rather profuse epistaxis, sometimes coming on while she was in bed. Three years previously she had had whooping cough severely.

The hypothesis that the diseased condition of her eye was the result of extensive intra-ocular hæmorrhage during the whooping cough receives a certain amount of support from the above

facts, especially as some blood patches were actually present in the eye; and I could not find any more probable explanation. There was no evidence of a cysticercus in the eye. She was the third of eight children, and showed no signs of syphilis. She was the only child in whom a tendency to bleeding from the nose had been noticed. None of her relations had had defective sight.

It was impossible to ascertain when the disease began, for, as already mentioned, the child had found it out only a few days before I saw her; the mother, however, had noticed the occasional divergent squint for two or three years at least. There had never been any redness or pain in the eye.

Three months later I saw her again, and found that the two blood patches had nearly disappeared, but that in other respects there was no change. The retinal detachment at the lower and outer part was noticed not to be moveable, its appearance being suggestive of solid material between retina and choroid.

CASE II. *Symmetrical Choroido-Retinitis in an Infant, probably Intra-Uterine.*

Eliza T., æt. three months, was brought to the hospital in November, 1875, with the statement that she had never "taken notice." The eyes looked healthy; the pupils were of ordinary size and acted well to light, but they dilated very imperfectly with atropine, although showing no signs of iritis. Although the strongest solution of atropine was repeatedly used both at the hospital and for many days at home, the pupils could scarcely be dilated to half their full size.

The ophthalmoscopic appearances were alike in both eyes, but there was perhaps rather more extensive disease in the right. The disc, and the retina around it for a considerable distance, were quite concealed by dense misty whitish lymph or effusion, in which the retinal vessels were hidden. This white area measured many times the size of the disc; for the most part it thinned off gradually, so that towards its borders the underlying choroid could be dimly seen. No trace of the disc itself could be seen, and its position was only guessed at by the convergence of the vessels. Beyond the margins of the white effusion there were numerous large patches of

atrophied choroid. These were abruptly defined, and the atrophy appeared to be complete, the sclerotic shining through; on many of them there was much coal-black pigment, but others were merely white. The choroidal disease extended beneath the opaque retina, for masses of pigment, looking blue-black as seen through the misty opacity, could be seen here and there beneath the less dense parts of the diseased retina. The retinal vessels were easily distinguishable in the more peripheral parts, but it was difficult to form a positive opinion as to their size, since they were quite obscured for some distance around the discs.

The child was the youngest of three; the two elder ones, aged 4 and 2, were reported to be well; I afterwards saw the eldest, and found no signs of inherited syphilis in it. The patient was a well-grown, plump child, and although I at first thought the eye-disease syphilitic, nothing was found to confirm the suspicion; she had had slight snuffles and a little rash about the buttocks, but there was nothing characteristic. I questioned the mother indirectly, and afterwards directly, as to syphilis, and without eliciting any suspicious facts; she was most anxious about the child, and would, I think, have told me if she had known of anything. The child was habitually sleepy, but this seemed sufficiently accounted for by its blindness. Its cranium was small, and its face not quite symmetrical, being apparently rather smaller on the left side.

From the ophthalmoscopic appearances it seemed highly probable that the choroiditis had occurred during intra-uterine life. Such a disease would not be expected as the result of syphilis, for the choroido-retinitis of inherited syphilis seldom occurs under a year old, and is much more commonly deferred to the age of two or three years. The general features of the disease were also different from those of syphilitic choroiditis, either in the acquired or inherited disease.

The symmetry of the malady would, however, seem to point to some constitutional cause. I may note here, for what it is worth, that the mother, when four and a half months pregnant with the patient, was laid up for a fortnight with an illness in which vomiting and obstinate constipation without much pain were the only symptoms of which she could give an account. There was no family history of bad sight. Mr. Hutchinson, who was kind enough to examine the case, first suggested to me

that the disease was probably not due to syphilis. Mercurial treatment, as being the only means that could be supposed capable of assisting in the absorption of the retinal opacity, was persevered with for many weeks. Hitherto, however, no change has taken place in the ophthalmoscopic appearances, and the child remains quite blind, though in good health and well grown.

*A case illustrating the progress and result of a Retinal Hæmorrhage.  
Case under notice for 13 months.*

Records of cases where hæmorrhages or other deposits in the retina are under observation for a long time, are desirable, both to aid in prognosis and to help us in the interpretation of other cases.

Mary Anne H., æt. 41, came to the hospital on *December 23, 1874*, on account of her right eye, which had, she said, been failing for the last three weeks. The visual field was much contracted and broken, and she could see only letters of 16 J. and  $\frac{2}{3}$  Sn., and she said that she could not see the whole of any single letter at once. The sight of the other eye was perfect. Ophthalmoscopic examination of the right showed a large area of retinal hæmorrhage, beginning at the (real) upper edge of the disc, and passing upwards and outwards over and beyond the yellow spot: the yellow spot itself was partly involved. The affected part was almost entirely covered with streaks and dots of blood, the streaks being the more numerous. A considerable branch of vein and artery ran through the midst of the diseased area. The rest of the fundus was healthy.

Two months later, *February 27, 1875*, the appearances were nearly the same, the central part being an almost uniform patch of very dark blood, while further outwards this gradually passed into a number of thickly distributed small spots, giving a stippled appearance. The yellow spot itself was now free, the blood ceasing at an abrupt line somewhat above it; it may be surmised that this abrupt limitation towards the yellow spot was related to the distribution of the retinal nerve-fibres. There was slight haze of the retina between the edge of the disc and the thickest part of the blood patch.

At the end of six months (*June 12*) I made the following note, "The blood is to a great extent absorbed. There are now



ill-defined, scattered, thin spots or stains, where formerly there were numerous well marked thickly placed spots. The haze of retina has given place to several fine, almost tendinous looking streaks, which take the direction of the nerve-fibres, and are so thin as scarcely to obscure the vessels over which they pass; "the sight had by this time improved a good deal.

At the end of 13 months from admission (*January 29, 1876*), the following was noted, "There is a slight remnant of hæmorrhage in the form of an ill-defined patchy streak close to the edge of the disc; in the erect image it is seen to cover a small vein. The neighbouring vessels are somewhat distorted, no other changes." The V. of this (the diseased) eye was now 6 J. fairly: with the other she saw 1 J.

The hæmorrhage in this case no doubt proceeded from the rupture of one of the larger vessels, the whole patch being in this sense a single hæmorrhage. It was probably comparable to conjunctival ecchymoses from coughing, and due to disease of the blood vessel. She gave the history of an attack of giddiness and temporary paralysis of the right face, followed by great debility lasting some weeks, about three years before the eye failed; very probably a cerebral hæmorrhage. Her father died of "diabetes;" there was no positive history of apoplexy in the family. Her urine was tested, but contained neither albumen nor sugar.

## CURATOR'S PATHOLOGICAL REPORT.

By WM. A. BRAILEY, M.D.,

*Curator of the Royal London Ophthalmic Hospital Museum.*

Statistics of the causes leading to excision of the eyeball, between October 1st, 1874, and February 16th, 1876.

During the above period there have been recorded in the Moorfields Hospital 198 cases of excision, 129 being male and 69 female patients. This large preponderance of male sufferers is accounted for by their being more exposed to injuries, for we find that out of 113 cases of eyes thus lost, the males are in the proportion of 3 to 1, being 85 males to 28 females. Dangerous trades account for the greater part of this large difference, for, of the 46 eyes whose destruction is due to trade work, only one is the eye of a female. By far the most destructive trades appear to be those in which iron is worked in, either by being struck or turned. Very minute fragments of iron and steel, especially when cold, are broken off and scattered with a velocity sufficient to penetrate the eyeball, for 22 out of 46 eyes lost in trade have lodged in them fragments of iron.

Out of the 46, nineteen are smiths, fitters, boilermakers, iron turners, &c., while 4 carpenters have lost eyes through striking chisels. Agricultural labourers have supplied 6 cases needing excision, but wounds from thorns whilst hedging have to account for the majority of these.

Of the eyes enucleated on account of wounds not acquired in trade, 34 belong to children under 14 years of age, and these have been nearly all lost at play, the instruments of destruction among girls being generally sewing needles or forks with which knots are being untied often in bootlaces, and among boys, knives, tip-cats, and other toys. About a year ago, a tin toy sold in the streets as Captain Boyton's flying signal, which consists of a bit of metal like a ship's screw, capable of being revolved by means of a string, and so rising in the air to a great height, destroyed, by its misdirection, two eyes within a few days. Those left, out of the sum total of wounds and injuries are 33 in number, of whom 19 are males and 14 females, and are principally due to accidents in the streets, with the exception of a few eyes lost in both sexes after operations, and several, especially in women, by the springing up of sticks which are being chopped upon stone floors.

Of the eyes enucleated for disease independent of injuries, 44 are of males, and 41 of females. In glaucoma, women appear in the proportion of 3 to 1 male, and in the sequelæ of exanthems they suffer in the proportion of 2 to 1 male. The same proportion prevails in ophthalmia neonatorum, while to gonorrhœal ophthalmia men seem much more liable. Sarcomata are about equally divided between the sexes, but gliomata are much more common in males. Deeper inflammatory affections of the eyeball, of which probably many are syphilitic in character, affect 3 males to 2 females.

In considering the question of the liability of the right and left eye to disease, as indicated by excision, we find that the left is more numerously affected in the proportion of 5 to 4 right (107 to 84). But when we deduct the cases of wounds and injuries, to which they seem liable in equal proportions, the percentage of excess of disease in the left eye is more marked, the numbers being 53 left to 30 right.

Thus, 8 left glaucomatous eyes have needed excision in proportion to 4 right. The same relation holds good in the sequelæ of exanthems, and in ophthalmia neonatorum; while in gonorrhœal ophthalmia, probably from the greater use of the right hand as a conveyer of contagion, the right suffers most. Of the tumours, the sarcomata appear to affect the right side rather more, while the gliomata are far more abundant on the left side, for in the period treated of, out of 8 glioma cases, all are on the left side. In 2 cases in which the disease was double, the left was more advanced and alone required excision on account of the pain. In other inflammatory affections of the eye, the left side has suffered in rather greater proportion.

It is very interesting to find that the results above given are substantially confirmed in both questions of sexes and sides by an examination of the hospital books kept by my predecessors for several years back. The greater liability to loss of left eyes, and the greater liability of women and female children to lose eyes from the exanthems, glaucoma, and ophthalmia neonatorum is strikingly shown. It is again remarkable that while sarcoma is about equally distributed between sexes and sides, glioma is much more abundantly found in the male sex and on the left side. The excess of inflammatory affections in male eyes is equally marked here.

The following is a tabular account of eyes removed on account of injuries, from July 1, 1875, to February 16, 1876. Several specimens of which an accurate history could not be got, and a few which were opened independently of the curator in the theatre, are omitted from this list, others again are simply enumerated here, as they are described fully among the reported cases :

TABLE I.—*Eyes containing a Foreign Body.*

| Name, Age, and Date of Excision.                                                                                 | Nature of Accident.                                                         | Time between Accident and Excision. | State of Injured Eye, and the other up to the date of Excision.                                                                                                                                                                                                                                 | Changes found in Excised Eye.                                                                                                                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 561. See Report, p. 542.<br>565. Enoch P. 30.<br>Left. July 22, 1875.<br>Hutchinson.                             | Wound by fragment of steel from chisel.                                     | 6 months. . .                       | Much pain for a month after the injury; pain abated but returned after exposure to cold, and lasted six weeks more; right was painful towards end of this time. Pain again in left for last fortnight. Right a little dazed; left globe shrunken and squared. T— . Iris muddy, pupil irregular. | Lens soft, clear. Capsule opaque. Brownish fluid between choroid and retina. Retina funnel-shaped. Remains of vitreous contained in front of its cavity; at lower part of which is imbedded the piece of steel. From the retina near it tough adhesions run to the neighbouring choroid. |
| 570. Richard S. 53.<br>Right. Aug. 5, 1875.<br>Hutchinson.                                                       | No recollection of any accident.                                            | Probably 36 years.                  | Thirty-six years ago pain and inflammation. Since then occasional inflammation. P.L. up to four months ago. Iris tremulous, pupil small.                                                                                                                                                        | Scleral staphyloma at upper and inner part of equator. Irregular retinal pigmentation there. Scale of iron, $\frac{1}{8}$ in. square, at lower part of equator. Lens absent.                                                                                                             |
| 601. See Report, p. 550.<br>614. See Report, p. 556.<br>618. Henry C. 48.<br>Left. Oct. 23, 1875.<br>Wordsworth. | Wound by scale of iron $\frac{1}{4} \times \frac{1}{8}$ inch, from a rivet. | 6 weeks. . .                        | P.L. till ten days ago. Slight pain over brow ever since accident. Fancies right also a little dim. Vertical wound on inner side of left sclero-corneal junction, in the scar of which a little pigment is involved. T — . Below right cor-                                                     | Pupil closed. No synechia. Lens <i>situ</i> and clear. Wound goes through ciliary processes. Retina funnel-shaped. Front part of its cavity contains the semi-globular remains of the vitreous. In lower part of this is lymph                                                           |



|                                                       |                                                                                                                                                     |         |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
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| 624. David F. 39.<br>Left. Nov. 5, 1875.<br>Couper.   | Wound by fragment<br>from steel chisel $\frac{1}{8}$<br>$\times \frac{1}{8}$ inch. Sharp<br>and angular.                                            | 25 days | .. | <p>neal centre is a slight superficial opacity. Is exposed to fragments of rust, &amp;c., in his work of caulking ships.</p> <p>In this hospital for the first fifteen days after the accident. Great pain on the 2nd, 3rd, 4th, and 5th nights, relieved by artificial leech. When left hospital on 15th day still retained p. l., and had but little pain, but this then returned immediately, and p. l. ceased. Right eye a little weak and dim for last ten days.</p> | <p>with minute hæmorrhages, and here imbedded is the scale of iron. There is an additional adhesion of the retina to the choroid at the yellow spot.</p> <p>Wound through cornea just nothing outer pupillary margin. Pupil small, irregular. Lens opaque. Straw-coloured fluid between choroid and retina. Retina soft and greyish, tubular behind to O. D., semi-globular in front; containing the glassy, greenish shrunken vitreous. Foreign body found in mass of lymph and blood clot at lower part of vitreous.</p> |
| 632. John K. 52.<br>Left. Nov. 27, 1875.<br>Couper.   | Wound of cornea, &c.<br>by fragment of iron<br>which he was cutting<br>with a steel<br>chisel. Fragment<br>= $\frac{1}{4} \times \frac{1}{8}$ inch. | 4 days  | .. | <p>Total darkness directly. Much pain next day and ever since. Lens extracted next day without finding the foreign body.</p>                                                                                                                                                                                                                                                                                                                                              | <p>Blood between retina and choroid. Choroid except at occasional round spaces, lined by a layer of pus. Retina soft, red, and shreddy, tubular behind, globular in front, where it contains shrunken greenish vitreous. (The piece of iron was extracted in the theatre.)</p>                                                                                                                                                                                                                                             |
| 641. Robert B. 21.<br>Left. Dec. 11, 1875.<br>Couper. | Transverse wound of<br>cornea and sclerotic<br>by fragment of hammer<br>head, $\frac{1}{2} \times \frac{1}{8}$<br>inch.                             | 20 days | .. | <p>Never pain. Lost p. l. after four days. Right has watered a little since, but this is not unusual with him. Wound extends from corneal centre outwards to one line beyond corneal margin. Iris adheres to cornea at wound.</p>                                                                                                                                                                                                                                         | <p>Lens opaque and <i>in situ</i>. Rupture in retina and choroid on outer side of O. D. Edges of the ruptured choroid adhere to the disclosed rather rough and puckered white sclerotic. Neighbouring vitreous purulent and con-</p>                                                                                                                                                                                                                                                                                       |

TABLE I.—*Eyes containing a Foreign Body—continued.*

| Name, Age, and Date of Excision.                      | Nature of Accident.                                                                                       | Time between Accident and Excision. | State of Injured Eye, and the other up to the date of Excision.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Changes found in Excised Eye.                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 641 <i>continued.</i>                                 |                                                                                                           |                                     | Purulent lymph blocks pupil and adheres to wound.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | taining blood clots. On ciliary processes below wound is seen pus, and on and near ciliary body above blood clots. Retina soft, loosely lying on choroid. Foreign body lying loosely in vitreous close to ciliary processes below wound.                                                                                                                                          |
| 661. Horace E. 33.<br>Left. Jan. 22, 1876.<br>Couper. | Wound of cornea, iris, lens, &c., by fragmentation of steel screw, $\frac{1}{8} \times \frac{1}{8}$ inch. | 17 weeks.                           | On admission, scar in cornea on nasal side and in iris just behind it. Traumatic cataract. P.L. and visual field good. In bed for three weeks after accident, with occasional severe pain in both. After that occasional trifling pain in left, brought on by slight causes, such as exposure, reading with right, &c. During last three weeks two severe attacks of pain and inflammation in left. Right has watered. Its V. = $\frac{2}{3}$ . Lens of left extracted day before excision, followed by great pain all night. Cornea infiltrated with pus. Pupil blocked. No anterior synechia. | Choroid has blood under it, and is readily detached from sclerotic. Retina soft, lying loosely on choroid, carries away adhering to it in patches its pigment epithelium. Vitreous turbid, carries away with it pigment epithelium from ciliary processes; just beginning to shrink up and leave retina behind. Foreign body just behind the lower part of the ciliary processes. |

|                                                     |                                                                                                                                                                                                                 |        |                                                                                                                                                                                                   |                                                                                                                                                                                                                                                        |
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| 669. James C. 47.<br>Left. Feb. 4, 1876.<br>Couper. | Large wound of sclero-<br>corneal margin by<br>fragment of iron<br>from rivet, pulled<br>out by patient at<br>time of accident, $\frac{1}{2}$<br>$\times \frac{1}{4}$ inch $\times \frac{3}{16}$ inch<br>thick. | 1 day. | .. Loss of tissue at wound, extend-<br>ing on to cornea, and $\frac{1}{4}$ inch back<br>in sclerotic. Lens soft, has<br>nearly all escaped. Vitreous<br>protruding. No p. l. after acci-<br>dent. | Choroid soft, thick, reddish-brown.<br>Soft semi-coagulated bright blood<br>under it all over. Large clots<br>behind ciliary processes on oppo-<br>site side of eye to seat of wound.<br>Retina loosely attached to cho-<br>roid, but <i>in situ</i> . |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

TABLE II.—*Eyes Wounded or Ruptured.*

| Name, Age, and Date of Excision.                                                        | Nature of Accident.                                       | Time between Accident and Excision. | State of Injured Eye, and the other up to the date of Excision.                                                                                                                                                                                                                                   | Changes found in Excised Eye.                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 553. See Report, p. 536.<br>554. Bessie H. 14.<br>Left. July 2, 1875.<br>Couper.        | Peck from a fowl, which she was teasing                   | 11 years ..                         | No p. l. since accident. Left eye very painful then and occasionally ever since. Worse pain fourteen days. Right never affected.                                                                                                                                                                  | Sear at upper part of cornea, in which iris is closely involved. Rest of iris free. Anterior chamber deep. Retina detached, umbrella-shaped, brown fluid between it and choroid. Lens absent.                                  |
| 566. Leonard V. 3.<br>Left. July 23, 1875.<br>Lawson.                                   | Wound by tin toy, called Captain Boy-ton's flying signal. | Few hours ..                        | Cornea and sclerotic wounded, lens escaping. Iris prolapsed. Vitreous running away.                                                                                                                                                                                                               | Blood under whole extent of choroid. Retina detached, soft.                                                                                                                                                                    |
| 567. See Report, p. 544.<br>568. Mary Jarvis.<br>31. Right. July 26, 1875. Streatfield. | Ran fork into eye when untying boot lace.                 | 26 years ..                         | No p. l. since the injury. No pain till eleven years ago, when some operation, said to be for cataract, was done. Eye very painful then. Inflamed three or four times yearly ever since. In last few months has been getting large, and <i>left</i> has been dim. Tension of <i>right</i> normal. | Staphyloma of cornea and of ciliary region. Apex bulging on inner and lower side of cornea, here opaque, elsewhere semi-transparent. Lens capsule thick and opaque, rim of lens matter remaining. O. D. excavated. Y. S. dark. |
| 569. George T. 14.<br>Left. Excised July 29, 1875. Streatfield.                         | Wound by Captain Boyton's flying signal toy.              | 6 weeks ..                          | Pain in eye day after accident, lasted up to date of excision. Wound from corneal centre running inwards $\frac{1}{4}$ inch into                                                                                                                                                                  | Lens absent. O. D. swollen and indistinct. Y. S. dark. Veins of O. D. dilated. Retina soft, lying loosely <i>in situ</i> . Vit-                                                                                                |

reous a little opaque near seat of wound. Here retina is a little raised from choroid.

Choroid thickened, *in situ*. Retina generally loosely in apposition with choroid, but separating from it behind. Vitreous just beginning to suppurate.

Wound of cornea, ciliary region, iris, and lens, pus in A. C. Vitreous beginning to suppurate. Retina lying very loosely attached to choroid.

sclerotic. Iris dull yellowish.

At excision, *left* painful. T—.  
Scar at lower part of cornea.  
Anterior synechia, bulged cornea.  
Right eye healthy. Aug. 30.  
*Right* red and watery. Iris discoloured (?), pupil active, dilates round with atrophine. On Sept. 2. O. D. hazy, its veins large and tortuous. Eye more congested. On Oct. 28. Still some irritation of the right eye. The early symptoms threatened sympathetic ophthalmitis. These soon subsided, and there was never iritis. Subsequently a rather troublesome conjunctivitis with granular lids came on, probably due to the continued use of atrophine. The earliest symptoms occurred four or five days after the excision.

Much pain first four weeks, none since. Has bare p. l. *Left* a little dim and watery ever since the accident.

Wound by scissors while untying a knot.

586A. Emily F. 8.  
Left. Aug. 26, 1875.  
Hutchinson.

6 weeks

Wound by the rebound of a piece of wood, which he was chopping

588. Henry B. 36.  
Right. Aug. 31,  
1875. Critchett.

6 weeks



TABLE II.—*Eyes Wounded or Ruptured—continued.*

| Name, Age, and Date of Excision.                                                     | Nature of Accident.                                                  | Time between Accident and Excision. | State of Injured Eye, and the other up to the date of Excision.                                                                                                                                                                                                                                                                                                 | Changes found in Excised Eye.                                                                                                                                                                                                                                                                                                                                     |
|--------------------------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 594. See Report, p. 547.<br>599. Ann L. 22.<br>Right. Sept. 22,<br>1875. Wordsworth. | Wound by fork ..                                                     | 16 years ..                         | No p. l. since injury. Globe has been getting gradually bigger ever since the accident. Pain and inflammation for last few weeks. Opaque spot in centre of cornea, the upper margin of the very small pupil adheres to this by a pointed process. Upper $\frac{2}{3}$ of cornea and corresponding ciliary sclerotic much bulged to form a prominent staphyloma. | T. +. Antero-posterior diameter of globe = 15 lines, transverse = 12, vertical = 11 lines. Iris surface covered with greyish-white radiating striae; it is stretched into a fine network. O. D. deeply cupped. Dotted pigment above and to outer side of O. D., and at equator above. Patches behind ciliary circle devoid of pigment. Lens = a calcareous scale. |
| 629. James B. 10.<br>Right. Oct. 18,<br>1875. Hutchinson.                            | Wound by a child's bow and arrow, each made out of an umbrella wire. | 4 weeks ..                          | Much pain in it at night ever since the accident. Other eye unaffected. Globe shrunken, squared; wound of outer corneal margin near sclero-corneal junction. Scar linear-vertical. Iris adherent to it. Pupil small, drawn to outer side.                                                                                                                       | Retina soft, lying in loose folds on the choroid. Straw-coloured thin fluid replaces vitreous. Lens clear and <i>in situ</i> . Vascular lymph behind lens.                                                                                                                                                                                                        |
| 631. Ada D. 4. Left.<br>Nov. 23, 1875. Bowman.                                       | Wound by penknife in hand of her little brother.                     | 26 days ..                          | Child lively and slept well till excision. T —. Transverse wound on front of cornea. Vitreous bulging through wound.                                                                                                                                                                                                                                            | Lens O. Vitreous transparent, fluid, separates readily from retina behind, and carries on its surface blood stains. O. D.                                                                                                                                                                                                                                         |

swollen, indistinct, swelling obscures the first part of some of the blood vessels. Y. S. is a small dark spot in the centre of a dark area.

Much bright blood between choroid and sclerotic, near ciliary processes and equator. Vitreous transparent, slight yellow tinge, readily separates from retina behind. O. D. rather indistinct. Remains of lens shreddy and adherent to iris. No lymph on ciliary processes.

Eye very soft. Cornea soft, opaque, purulent. Vitreous full of pus, especially close to ciliary processes, elsewhere less infiltrated, separates readily from retina behind, leaving some patches of pus on it. Retina soft, containing numerous minute hæmorrhages.

Cornea replaced by cicatricial tissue; a calcareous scale, covered behind by a tough fibrous layer, adheres firmly to its posterior surface. Retina funnel-shaped.

Pupil closed by a mass of lymph.

A very little pain in left on first day only. No p. l. for first week, then could perceive shadows. *Right* eye a little inflamed four days after accident, and sight a little dim; all subsided next day. Scar extends upwards from lower corneal margin to its centre. Lower segment of iris deficient, margins of this gap adherent to scar; lymph on iris and round pupillary margin. Glass imbedded in right cornea for thirteen weeks. After four weeks the *other eye* inflamed, remained bad till two weeks after glass removed from right. Now central nebula and weakness in *left*. Ulcer in right, with occasional pain and inflammation ever since the first accident.

Eye swollen and closed for three weeks after accident. Had p. l., seeing a red haze only for three years. Since then no p. l. Eye inflamed occasionally about once in three months since from cold or irritation of decayed teeth. Left never affected.

636. Arthur B. 14.  
Left. Dec. 3, 1875.  
Critchett.

Wound by rebound of chisel.

17 days

..

640. John C. 50.  
Right. Dec. 9, 1875.  
Hutchinson.

A fragment of steel broke the glass of his right protective spectacle, and the glass wounded cornea four years ago. Blow with snowball three days ago.

First 4 years.  
Second 3 days.

643. Alfred D. 25.  
Right. Dec. 16,  
1875. Hutchinson.

Fell down hatch of ship on to a cargo of coals and wounded eye.

8 years

..

TABLE II.—*Eyes Wounded or Ruptured—continued.*

| Name, Age, and Date of Excision.                             | Nature of Accident.                                          | Time between Accident and Excision. | State of Injured Eye, and the other up to the date of Excision.                                                                                                                                                                                                                                                                              | Changes found in Excised Eye.                                                                                                                                                                                                                                     |
|--------------------------------------------------------------|--------------------------------------------------------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 647. Mary Ann G.<br>41. Left. Dec. 28,<br>1875. Critchett.   | Ran against projecting old-fashioned door latch in the dark. | 13 days ..                          | Slight pain night of accident, and but little since. P. L. first week. Right watered day after accident and after excision.                                                                                                                                                                                                                  | Transverse penetrating corneal wound, to which iris is adherent by much lymph. Lens soft. Vitreous clear, separating from retina behind. O. D. swollen. Veins enlarged. Serum under posterior part of retina. Bright hæmorrhages on ciliary processes near wound. |
| 652. Arthur N. 8.<br>Left. Jan. 4, 1876.<br>Critchett.       | Wound by tip-cat ..                                          | 1 day ..                            | Said much pain and no p. l. after accident. Slept fairly that night. Other eye all right. Eye collapsed. Transverse jagged wound right across cornea. P. L. for four days after accident, then slough of cornea. During last ten days much pain and swelling. Right unaffected till after the excision of left, then a little dim for a day. | Iris covered with lymph, and vitreous protruding. Lens O. Choroid soft, dark red. Retina detached to a soft greyish button.                                                                                                                                       |
| 655. Louisa C. 66.<br>Left. Jan. 10, 1876.<br>Streatfeild.   | Blow from fragment while breaking a piece of coal.           | 3 months ..                         | Wound of cornea near lower margin, iris protruded. Discharged from hospital, Sept. 1875; returned in Jan. with <i>right</i> T. + 1; p. l. Iris dull, photo-                                                                                                                                                                                  | Vitreous greenish, translucent. Retina funnel-shaped, soft. Hæmorrhages in it and on choroid. Lens <i>in situ</i> .                                                                                                                                               |
| 657. Rose Ann F.<br>12. Right. Jan. 17,<br>1876. Hutchinson. | Prick with sewing needle.                                    | 4½ months ..                        |                                                                                                                                                                                                                                                                                                                                              | Cornea clear. Lens clear, <i>in situ</i> . Lymph on back of lens capsule and on ciliary processes, especially below. Vitreous yellowish, separable from retina                                                                                                    |

|                                                          |                                          |         |    |                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------------------------------------|------------------------------------------|---------|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 663. Joseph A. 40.<br>Left. Jan. 21, 1876.<br>Critchett. | Globe ruptured from<br>blow with finger. | 8 days  | .. | phobia. <i>Left</i> sympathetic oph-<br>thalmia soon after she left hos-<br>pital in Jan. Pupils small, nearly<br>blocked. T + 1. Very little<br>pain till day before admission.<br>other eye not affected.                                                                                                                                                                      | behind. Retina mottled with<br>lighter coloured patches near<br>disk.<br><br>Globe ruptured round cornea.<br>A.C. full of blood. Lymph on<br>iris. Lens O. Retina lying<br>loosely on choroid. Recent blood<br>clot behind lens capsule. Vitreous<br>replaced by brownish fluid.<br>Choroid thick, chocolate coloured.<br>Scarcely bright recent hæmorrhage<br>under it. Lens O. Vitreous<br>clear. Retina apparently normal,<br><i>in situ</i> .<br>Vitreous clear. One or two small<br>bright hæmorrhages in it. Rest<br>of fundus healthy. |
| 672. Robert C. 42.<br>Right. Feb. 11, 1876.<br>Lawson.   | Wound by fragment<br>of glass bottle.    | 2 years | .. | Not much pain till purulent in-<br>filtration of cornea two weeks<br>after accident. Till then had<br>good vision. Ever since fre-<br>quently recurring pain.<br>Wound of upper and outer part<br>of cornea. Iris prolapsed. Lens<br>matter escaping gradually.<br>After six days lens had nearly<br>all escaped. Wound still gaping.<br>Iris in apposition with cornea.<br>P.L. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 676 George D. 36.<br>Left. Feb. 16, 1876.<br>Wordsworth. | Wound by chip of<br>iron.                | 8 days  | .. |                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

TABLE III.—*Eyes Lost by Blows, Scratches, etc.*

| Name, Age, and Date of Excision.                                                                                 | Nature of Accident.                             | Time between Accident and Excision. | State of Injured Eye, and the other up to the date of Excision.                                                                                                                                             | Changes found in Excised Eye.                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 557. See Report, p. 539.<br>572. James H. 37.<br>Right. Aug. 5, 1875.<br>Hutchinson.                             | Injury from a falling rocket stick.             | 25 years                            | Painful at time of accident. Bare p. l. ever since. No further pain till last three or four months.                                                                                                         | Lens shrivelled, only attached at upper and inner part of its circumference. Sclerotic thin behind. Patch of atrophy in choroid below O.D. Retina <i>in situ</i> , dotted black pigment about Y. S. Small white patches in choroid behind ciliary processes. |
| 576. See Report, p. 544.<br>609. See Report, p. 552.<br>617. B. A. 62. Left.<br>October 20, 1875.<br>Wordsworth. | Injury from ear of wheat.                       | 45 years                            | After injury a little pain for a day or two. Sight went entirely in a month. No further trouble. Eighteen months ago got grit into it; occasional pain in left ever since, and slight photophobia of right. | Lower part of cornea opaque and abraded. Pupil very small, partly closed. Iris dull. Lens catarrhous, its centre amber-coloured. Sclerotic thinned in places. Vitreous clear, rather fluid. Pigment deficient round O.D. Y.S. very dark.                     |
| 621. Ann B. 63.<br>Left. Oct. 27, 1875.<br>Wordsworth.                                                           | Blow from piece of wood which she was chopping. | 6 weeks                             | Very little pain for first three days, then very much. No p. l. after fourteen days, then pain ceased, but began again before excision. Lens luxated into A. C. T. + .                                      | Posterior surface of lens covered with whitish opaque striae. Vitreous healthy. Retina <i>in situ</i> . White effusion on and round O.D. White lines on the arteries, which are small, from O.D. Y.S. dark.                                                  |



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| 634. Elizabeth S. 55.<br>Right. Nov. 29, 1875.<br>Hutchinson. | Same as 621 .. | .. 14 years. | Pupil widely dilated. Corneal<br>epithelium irregular.<br>Inflammation for six weeks. Then<br>barely p. l. Occasional pain<br>since, but while stooping thirteen<br>weeks ago, severe pain came on<br>and has continued since. Globe<br>enlarged. Pupil widely dilated.<br>Lens almost in contact with<br>cornea. T. + . Left eye normal. | Lens bulged forwards, but seems<br>to have its normal connections.<br>O.D. deeply cupped; vessels<br>small. Vitreous clear, separates<br>readily behind. |
|---------------------------------------------------------------|----------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|

553. *Examination of an Eyeball, excised July, 1875, six months after an injury.*

Chas. F., æt. 13, under care of Mr. Couper. While playing with a powder flask six months ago, it exploded and cut the right eye. This was inflamed and painful for a month, but has given no trouble since. No perception of light since the accident. Excised as a precaution.

Eye shrunk, scarcely any remains of cornea visible. In the centre of the front of the globe is the scar of a penetrating wound. Sclerotic thick. Choroid *in situ* and a little mottled in appearance near the O.D. Retina entirely detached. Its remains are coiled up in front, where it is closely applied in the position of the posterior layer of the lens capsule. Lens absent. A straw-coloured fluid is found between the retina and choroid.

*Microscopical Examination:* Sections through the centre of the front of the globe show the place of the cornea to be occupied by fibrous tissue irregularly arranged and abundantly provided with nuclei. A little in front of the posterior border of this layer, a small space encloses a wonderfully convoluted structureless layer, which may be the posterior elastic lamina or the lens capsule. Continuous with this irregular fibrous tissue behind is a layer, the anterior and thicker part of which is crowded with nuclei, while its back is made up of a stratum of deeply pigmented cells. This layer has much the structure and appearance of the iris. Close behind is coiled up in an intricate way, and on a much larger scale than the posterior elastic lamina, a layer whose outer part is made up of numerous short fibres arranged at right angles to its free surface, and having on this surface a layer of granules like those of the retina, and more internally another similar distinct layer. Inside this is seen a layer of indistinctly arranged fibrous tissue, in which nuclei rarely and feebly stain. In the outer part of this are seen a few cavities, as if formerly occupied by never cells, while towards the inner surface the fibrous arrangement is indistinctly longitudinal, representing probably the never fibres. The whole membrane obviously represents the retina, whose granules and radiating fibres appear to be much less perishable than its other elements.

555. *Enucleation of right Eye for inflammatory attacks recurring ever since its destruction by Gonorrhœal Ophthalmia, 9 years ago.*

Thos. B. N., æt. 25, single, shopman, under the care of Mr. Streatfeild.

The original inflammation of the right eye was accompanied by a thick yellow discharge, and was followed by a similar attack in the left after a few days. A young man who occupied the same room with him had gonorrhœa at the time. *Right* has no p. l. T - 2. *Left* has leucoma and anterior synechia; a. c. shallow; reads J. 1, and V. =  $\frac{20}{100}$ . It is occasionally painful, but less so than the right.

The right globe is shrunken and very soft. In the corneal centre is a small white vascular opacity. On equatorial section of the globe a thick yellow fluid escaped. Choroid *in situ*; on its front surface are numerous bright plates of cholesterine. A white rather fibrous looking mass with similar bright scales on its surface occupies the back surface of the posterior layer of lens capsule, and extends over the ciliary processes as far as the ora serrata. The front surface of the iris is covered with a thick whitish layer which occludes the pupil and forms a firm adhesion to the cornea. Just behind the iris and firmly adherent to it, is a tough fibrous opaque capsule which consists of two layers, containing between them a small opaque nodule evidently the remains of the lens. *Microscopically* the substance on the back of the lens capsule consists of fine fibres, having among them some bodies like vitreous corpuscles, and containing one or two dot-like nuclei and some granules.

556. *Case of supposed Glioma of Retina.*

Frank B., æt. 2 $\frac{1}{2}$ , under care of Mr. Lawson. Left eye excised July 6, 1875. Four days before excision, his parents noticed that there was a peculiarity of the eye, as if there were a slight cast in it. They had no reason to suspect that the child could not see with it, nor did he appear to have ever suffered any pain. He is healthy looking and well nourished,

with fair hair and blue eyes. He has suffered for 2 years from slight eczema and roughness of skin.

An equatorial section of the globe shows the O. D. to be very indistinct, and the early part of the vessels running from it to be surrounded by thick white streaks. They soon disappear altogether and the retina appears as if covered over almost the whole of its extent by white material of a similar nature, which at first seemed as if incorporated with its substance, but which after a few days soaking in Müller's fluid could be readily stripped off, leaving the retina with its surface not far from normal. The substance torn off is a white rather shaggy continuous layer of but little solidity. It would appear as if the vitreous had become condensed at its periphery to form a sort of membrane there on the retina. A microscopical examination shows it to be made up of a faintly granular scarcely visible matrix, traversed by some very finely fibrillated bands, and containing, scattered through it, corpuscles, some large, and others about twice the size of red blood corpuscles, both sizes having sometimes an appearance as if a second smaller corpuscle were attached to the side of a larger one. At several places are seen mixed up with these, clusters of bodies like pus cells, and frequently containing other corpuscles in them; but none of these are diffused through the mass. The retina presents all its elements; the rods and cones are enlarged at their distal ends, which sometimes appear club-shaped, and at other times like fat globules; their length seems less than usual. The granule layers are normal. Internal to these, scattered nuclei probably represent those of the nerve cell layer, and inside this again is the indistinctly longitudinal fibrous arrangement, with its small rare nuclei, which represents the nerve fibre layer. The internal limiting membrane is at places a little ragged, and ending on it are the very plain expanded ends of the radiating retinal fibres.

558. *Examination of an Eyeball simulating Glioma in appearance.*

Arthur B., æt.  $1\frac{1}{2}$ , a healthy looking child, with brown hair and skin, under care of Mr. Couper. Fourteen days before the excision, the parents noticed something peculiar in the appearance of the right eye. For some time the child had not opened

that eye so freely, but there had been no pain or inflammation. The pupil is contracted, and the anterior chamber shallow. There is a whitish opacity behind the clear lens.

An equatorial section shows that the retina extends as a cord from the optic disc, and spreads out in front over the back of the lens, &c., to its attachment at the ora serrata. Between it and the lens is a white opaque substance, the posterior part of which is looser, but whose front central part is very firm and dense. When teased out it is seen to consist of cells, the size of white blood corpuscles, containing nuclei and granules. They are frequently arranged in rows, and have intermixed with them very fine fibres; most of the cells are round, but some are drawn out at their ends. Acetic acid swells up the fibres and brings out the nuclei. A brown fluid containing red blood corpuscles and much granular debris fills up the space between the choroid and retina, and some old blood clots are adherent to the external retinal surface.

557. *Examination of an Eye enucleated some time after an injury on account of attacks of irritation (doubtfully sympathetic) in the other. Microscopical examination of scar of Iridectomy done some months after the injury.*

Richard R., æt. 42, fitter, a healthy looking, well nourished man, under care of Mr. Lawson. Four years ago he injured his right eye by striking it against the end of a bar of iron. For four months there was great pain in it, together with very imperfect vision, and a little dimness before the other eye. Then iridectomy was done, which relieved the pain in the right, and improved the sight of the left, though the first did not get any more vision, he counting fingers only with it. In this eye during the next three years there was no pain, and only slight occasional inflammation in the left, apparently due to dust, &c. Nine months ago a splash of water and grit from a steam hammer struck the left, which was inflamed during a month, and then got well again, its sight being nearly as good as before. In two more months it was again inflamed, and this recurred frequently and especially badly three months ago. The sight kept getting more dim, and seven weeks ago he first saw coloured rings round a light, and in another week he had another rather severe



inflammatory attack. The right eye was excised July 6, 1875. Its media are clear, there is an artificial coloboma upwards. No other scar than that of the operation can be seen. The sclerotic is very thin on each side of the centre of the globe, and has here the appearance of commencing staphyloma, elsewhere it is uniformly rather thin; the choroid has one patch deficient in pigment near the O. D. In several places bright red ill defined patches are seen as if from recent hæmorrhage. The retina is *in situ*, and apparently normal. The O. D. presents an apparently atrophic depression. There are marks of old iritic adhesions on the anterior layer of the lens capsule.

*Microscopically*; sections cut across the centre of the scar of the old iridectomy show that the anterior surface of the iris, from its periphery, as far as the scar, a distance of  $\cdot 5$  line, lies closely in contact with and adheres to the epithelium of Descemet's membrane on the posterior corneal surface; then the epithelium and posterior elastic lamina end, and a deep flask-shaped depression extends from the posterior corneal surface into its substance through  $\frac{4}{5}$ ths of its thickness. This is lined by the iris, the front part of which is continuous with the proper corneal tissue, while its uveal pigment lines the interior of the flask. When the iris emerges from the opposite border of the flask, it is free in the anterior chamber for about  $\frac{1}{10}$ th of a line, and terminates in a slightly expanded end, the nucleated elements of which are abundant, and show a disposition to be drawn out at opposite extremities. The thinned corneal layer over the flask has its fibrous tissue and nuclei irregularly disposed, and has distributed in its deeper portion some pigment from the iris, while superficially it contains blood vessels. The conjunctival pithelium above this is a little multiplied, and at one point a tongue-like process of epithelial cells runs down into the corneal tissue. Sections near the ends of the iridectomy scar show the iris simply running into the corneal tissue as a double fold, the two uveal surfaces of which are in apposition, while the anterior surfaces blend with the corneal tissue.

The pigment in the outer part of the choroid is less abundant than usual. More internally its stroma is loosely disposed, and has in it large spaces, some of which have a definite thin wall, and are obviously blood vessels, while others contain no blood corpuscles, and are less distinctly bounded. The basement

membrane and pigment epithelium are generally *in situ*. The last is occasionally and probably accidentally deficient.

The rods and cones are lengthened in places by their basal parts being attenuated and elongated into fine fibres, with intervals between them. The granule nerve-cell and nerve-fibre elements appear normal, but in the intergranular layers the radiating retinal fibres are frequently bent and separated from each other by spaces as if from old œdema. The O. D. forms a depression, the sides of which are shelving, one being steeper than the other. Beneath the nerve fibres as they are about to escape into the retina from the less steep side of the cup, is seen a globular mass of structureless material which has on its surface some smaller globules and resembles amyloid substance.

The defective manner in which the iridectomy wound cicatrised was probably caused by the prolapse of the iris demonstrated above.

#### 560. *Sarcoma of the Choroid.*

Mrs. D., æt. 59, under care of Mr. Bowman. Left eye excised June 29th, 1875.

When first seen in March, 1875, she stated that two or three months ago she accidentally discovered a blind spot below and on the right of the left field of vision, which afterwards increased in size. By the ophthalmoscope there was seen a pale buff reflex at the upper and outer part of the left fundus, which was elsewhere normal.

In front there are seen both above and below the cornea large varicose ciliary vessels, as in advanced cases of absolute glaucoma. T. normal in both. On June 10 the eye was inflamed and very painful after an attack of bronchitic catarrh. T. = + 2, slight chemosis, no p.l. for some months. The pain continued up to the excision.

The retina was found to be detached, except from the O. D. and in front, where it is folded in a little from the ora serrata, so as to contract the open mouth of the cone formed by its detachment. A tumour is found springing from the choroid about a line external to and a little higher than the optic disc and extending forwards, just beyond the equatorial line. Its elevation is about two lines. It seems to be made of two lower

lobes, of which the front is less pigmented than the one near the O.D., and a third much less pigmented one surmounting them. This has on its surface some loose whitish nodules about the size of pins' heads, some of which form an adhesion to the retina near them, a few similar smaller nodules are scattered on the choroid near. These, when picked out, have no tumour structure, but simply consist of finely granular matter. The superficial part of the tumour consists of oblong cells each with usually one dot-like nucleus. With them a very few fine fibres can be seen intermixed. At one or two places small collections of pigment are seen.

561. *Excision of an Eyeball containing a Foreign Body.*

Thos. W., æt. 53, married, carpenter, a healthy looking, dark complexioned man, under care of Mr. Critchett. Seventeen days before the excision, a scale flying from the edge of a chisel struck his right eye. For the last ten days he has had severe pain in it and the left has watered, but up till then he did not suffer much. A scar is seen towards the outer part of the cornea, and directly behind it the pupillary margin is notched. This corresponds to a small black pigment stain on the front of the softened yellowish lens and to a breach in its capsule in front and behind. The iron scale, whose surface is about a square line in area, lies on the ciliary processes just behind its point of entry, and from it there extends over them for about one-fifth of their circumference, a thin layer of whitish exudation.

The vitreous is colourless, normally adherent in front, but separating readily from the healthy looking retinal structure behind; microscopical sections show the suspensory ligament and the lens capsule to be normal, except at the seat of wound, and the lens fibres to be distinctly seen normally arranged in the inner half of the lens, while in the outer half, layers or bands of them are separated from the rest and arranged so as to form a series of deep wave-like folds. The choroid seems to contain about the normal quantity of pigment, though this is less marked on account of the enormous interspaces found in the choroidal substance; those in the outer part are large and generally contain blood corpuscles, while those more internal are larger

still, in some places reducing the stroma to a mere network, and generally containing no trace of blood corpuscles. The rods and cones and other retinal layers are *in situ*, but there appears to be some oedema and distortion of the elements of the inter-granule layer. The optic disc forms a triangular pit, not very deep nor excavated. The anterior surface of the iris is folded in, so as to form a groove in depth equal to  $\frac{2}{5}$  of the thickness of the iris, midway between its margins and parallel to them.

562. *A cord stretching from Disc to back of Lens; ? remains of Hyaloid Artery.*

Florence R., æt.  $3\frac{1}{2}$ , under care of Mr. Hutchinson.

Two years ago she had a very severe illness of three months' duration, in which she suffered from a cough with great diarrhoea and sickness after food. At the end of that time the sickness and diarrhoea ceased, but the right eye had gradually become very bloodshot and stood prominently forwards. In the next six months she continued to have a cough, which now resembled whooping cough, and to waste, and the mother was advised at the Childrens' Hospital to give her cod liver oil and milk, which proved of great benefit. Two other children in the house had whooping cough at the same time. Soon after that the eye was noticed to still look strange, and five months afterwards the mother tested it, and found it blind. For the last month it seems to have ached a little. She now no longer wastes and can eat well. On admission, the eye had an appearance as if of detached retina. The pupil is rather less than medium size, and its margins are irregular from adhesions at several points to the lens capsule. The anterior chamber is shallow and the lens is clear. An equatorial section shows a bluish-white fibrous opacity apparently of the posterior layer of the lens capsule, and in the centre of this a slender flattened white cord from the posterior part of the retina ends. The opacity is deficient at one point, showing the lens to be translucent. It extends laterally from the back of the lens as far as the ora serrata, and appears like a thickening of the pars ciliaris retinæ. On the posterior part of the interior of the globe there springs from the retina about in the situation of the optic disc, which is hidden by it, a quadrangular pyramid apparently composed of detached retina, whose sides are grooved in the direction of their

long axis. Its apex terminates in the cord above mentioned. It is continuous at its base with the rest of the retina, and its angles slope off into the general retinal level. In the groove between the upper and outer angles of the base of the pyramid is seen a darker coloured minute patch, apparently representing the yellow spot. Sections shew the cornea, sclerotic, ciliary muscle and lens to be normal, and the ciliary processes to be overlaid by an indistinct finely fibrillated tissue in which are numerous (stained) corpuscles with dot-like nuclei, intermixed with a few prolongations of pigment cells from beneath. The columnar cells of the pars ciliaris retinae with their elongated nuclei are lengthened so as to make the layer thicker than usual.

567. *Examination of the Retina of an Eye excised 7 weeks after perforating wound of Cornea and Lens.*

Margaret K., æt. 7, delicate looking, under care of Mr. Hulke. On June 1, 1875, while untying her garter with a fork, it slipped and its point entered her right eye. The injury was followed by great inflammation and pain, for which the eye was excised on July 24th. There is seen near the upper and inner corneal margin a wound, through which the iris was prolapsed, and in the scar of which it is entangled. There is a circumscribed bluish-white cloudy opacity of the lens a little below the seat of the wound, and below this again, just behind the periphery of the lens, is a white opaque nodule the size of a pin's head, from which the retina is stretched as a longitudinal fold radiating backwards, where it runs into the general retinal level. Microscopically, all the retinal layers are *in situ*, the radiating fibres are greatly lengthened and twisted in places so as to show gaps between them. This is seen near the O. D., between the internal limiting membrane and the granule layers, but at other places it is marked between the granule layers only. The nerve fibre layer contains many nuclei, and its vessels when seen in section have thickened walls surrounded by a vast number of closely aggregated deeply stained nuclei.

576. *Fibrous Cord in position of Hyaloid Artery.*

John A. D., æt. 15, a dark complexioned, healthy looking boy, under care of Mr. Critchett. Two years ago his left eye-



brow received a blow from the recoil of a toy cannon, after that he could only just see his hand move, though the eye has kept quite quiet, and has been bloodshot but rarely, and then only after exposure to a very high wind, &c.; nor has there been any pain. Now there is no p. l. About a month ago the right eye became bloodshot and the sight was dim: it has since watered a good deal, and there has been slight pain now and then. The left was excised on August 10, 1875. The cornea was clear. The iris only a rim. The margin of the pupil was irregular from adhesion, especially on the inner side, where there is an extensive adhesion to the lens capsule. The choroid is mottled near the O. D. with some faint white thickenings. The retina is detached into a funnel shape, and in the centre of the funnel, extending forwards from the O. D., is a tough fibrous cord which runs forwards for about  $\frac{1}{4}$  inch, and then bifurcates, the outer branch being flattened out over this side of the back of the lens capsule and blending with it, while on the inner side, one part similarly runs into the lens capsule, but a tough band runs to the choroid just behind the ciliary processes where it ends. This cord and its terminations are closely embraced by the detached retina. The cord consists of indistinct white fibrous tissue, along the centre of which a more marked band of fibres runs, in which a few rare pigment particles are scattered.

### 583. *Glioma of the Retina.*

Henry P., æt. 4, under the care of Mr. Critchett. Left eye excised August 24, 1875.  $3\frac{1}{2}$  months ago the pupil was noticed to be large and glassy. A month ago he had a blow on the left eyebrow, after which the eye was a little bloodshot; since then up to the date of excision, he has complained of a little pain in the morning. The patient is tolerably well nourished. His head is large, which is said to be due to fits in teething. His irides and hair are brown. There is a yellowish reflex from the fundus of the eye. An equatorial section shows the tumour to fill the cavity of the globe from the optic disc to the posterior surface of the lens capsule. The lens is clear and *in situ*. Sections show the vessels of the choroid to be numerous and normal, its epithelium to be *in situ*, and its stroma to present

stained nuclei not more numerous than usual. A mass projects forwards from the optic disc, and appears to be a blood vessel surrounded by a mass of glioma cells, which begin close to the disc. The cells are round or oval, generally drawn out or pointed at one end, and contain not very distinct nuclei. No trace of retinal structure can be made out any where. The ciliary muscle contains numerous nuclei, as also the iris, the external portion of which is adherent to the cornea, but they do not appear to be the nuclei of glioma cells.

The pigment epithelium over the ciliary processes is *in situ* and superficial to this is vitreous structure containing glioma cells loosely arranged in rows. The optic nerve contains numerous nuclei, but none can be made out to be the nuclei of glioma cells.

593. *Old injury of Eye, followed by Glaucoma symptoms in the other.*

Wm. D., æt. 25, married. A thin, fair complexioned man. Right eye excised by Mr. Wordsworth on September 8, 1875. While lighting a pipe with a fusee  $3\frac{1}{2}$  years ago, a spark flew into his left eye. Its charred remains were got out from under the inner angle two or three days afterwards. For the next nine days he suffered but very little pain, but then both eyes inflamed quite suddenly. He says he had no p. l. with either for fourteen days; then the left could see a little, and gradually improved, but the right never recovered its perception of light. The bulging below described came in the right eye nine months ago, but neither troubled him till six weeks ago, when, on a sudden change of weather, to which he was especially exposed, as a conductor on a tramway car, severe pain came on gradually in the right, and continued up to the date of excision. His family are phthisical. He has never had syphilis.

On admission, there is no scar on the left, but the right eye presents a leucoma just on the inner side of its corneal centre. There is a ciliary staphyloma on its inner side, which measures  $\frac{2}{5}$  inch from above to below, and  $\frac{1}{2}$  inch laterally, its elevation is about  $\frac{1}{4}$  inch, its margins are abruptly defined. The optic disc is deeply cupped, the vessels from its upper edge are extremely small; the yellow spot is very dark. The vitreous is clear, normal behind in consistency, but readily separable from

the retina there, more fluid in front, except over the ciliary processes, where it is as adherent as usual. Sections show that all the retinal layers are present, and that there is a hæmorrhage in the nerve cell layer near the optic disc. This is deeply cupped, its centre being less depressed than either side. One side is straight, the other overhanging, and has in its cavity some loose fibro-nuclear tissue. The floor teased out consists of fibres like nerve fibres, with a few nuclei among them.

594. *Examination of an Eye excised 6 weeks after a wound, the Optic Disc of which presents the appearance of Optic Neuritis.*

Walter L., æt. 15, an intelligent, healthy looking lad, with light hair and blue eyes. Left eye excised September 9, 1875, under care of Mr. Hutchinson.

Six weeks before excision, while at his work in a soda water manufactory, a bottle burst, and a fragment of glass cut the cornea of the left eye across. In about ten days there came on great pain in the eye, and it extended over the top of the head, and in four or five days more this ceased. He has had bare perception of light up to the date of excision. His right eye has good vision; it has had a little shooting pain occasionally but no redness. The eye is shrunk and somewhat square. There is the mark of a wound extending horizontally across the cornea on one side, as far as the sclero-corneal junction. The iris and cornea are glued together. The lens is absent. There is a faint bluish-white fibrous opacity at the back of the lens capsule, which extends over the ciliary processes. The optic disc is white and swollen, and there is a white shining extension from its edges.

Microscopic sections of the optic disc and neighbouring parts show the choroid to be congested, the apparent surface of the disc to be about level with the general retinal surface, and not to present any depression.

The fibrous tissue between the optic nerve bundles, as well as the fibres of the lamina cribrosa, are well marked, and in them are seen great numbers of stained nuclei arranged in rows. Above the level of the lamina cribrosa, slender lines of dot-like nuclei curving out from the optic nerve to enter the retinal nerve fibre layer, indicate the course of the nerve fibres,

Where they diverge, there are seen included between them the cut orifices of several blood vessels, which are surrounded by a great number of stained nuclei, and superficial to this, there appears to be something like a line of demarcation separating all the parts which lie superficial to the blood vessels of the disc. If this be accepted as real, it will leave the disc with a common rather atrophic condition of depression of its surface, and the triangular mass which fills it up, and which tapers off at its edges into the general retinal level, will belong rather to the vitreous than to the disc. This mass is made up near the apex of the triangle of stained bodies exactly like the retinal granules, and more superficially of short fibres tapering at each end and bulged in the middle, mixed with numerous nuclei.

596. *Examination of an Eye removed on account of a Retinal growth of somewhat doubtful character.*

Henry S., æt.  $3\frac{1}{4}$ , under the care of Mr. Streatfeild. At his birth, his left eye was noticed to be of a different colour from the other, but nothing further attracted attention till ten months ago, when the left was seen to have a vacant look. A yellow colour has been seen in it for three months. The child has lately put his hand up to the eye a good deal, but has made no complaint of pain. He is a very lively and well nourished child, with a fair complexion. The tension of the eye is increased. The lens transparent and *in situ*. A yellowish reflex, with some blood vessels and hæmorrhages on it, is seen through some clear vitreous. On opening the eye, two lobes are seen bulging forwards, they are in apposition behind, the folds extending to the optic disc, judging from the direction of the blood vessels; while in front they are separated by the remains of the vitreous. The lower lobe is solid, and appears to have no retina over it as a distinct membrane, while the upper one is made up of a fold of membrane like the retina, with some tumour mass situated either deeply in its substance or beneath it. The choroid appears everywhere *in situ*. Sections through the retina where it is membranous, show it to be abruptly folded, so that its vitreous surfaces frequently lie in apposition for some distance. The rods and cones are absent; the two layers of

granules remain throughout, but they stain but feebly. Several gaps and a few very pale nuclei represent the nerve cell layer, and a faintly fibrous arrangement superficial to this stands for the nerve fibres. At places, especially at the convexity of bends, the granules, especially those of the outer layer, are multiplied, and those on the exterior are replaced by yellow globules, apparently made up of collections of amorphous granules. The two folds of the retina directly after leaving the optic disc present the structure first described, but soon the outermost layers present the granular degeneration.

In other places, where the retina appears to be thickened into tumour-like masses, its structure is made up of fibres at right angles to its surfaces, most of which are very slender and unbranched, and which contain between them feebly stained nucleated bodies, which are either round or abruptly drawn out into fine fibres at one or both ends. In other places, perhaps especially towards the exterior of the mass, neither the fibres nor the nuclei appear to take the staining fluid, and are of a marked yellow colour. The nuclei are more abundant at certain points, perhaps corresponding to the inner and outer granules, and between these the fibres tend to stick together in rows.

This case illustrates the importance of microscopically examining doubtful growths. The naked eye characters of the specimen were such as would not have made its distinction from a glioma possible. The minute inspection appears to show that the nodular masses are the result of a slow inflammatory process, attended by thickening, folding, and detachment of the retina.

600. *Examination of the Optic Discs in the case of Optic Atrophy from lead poisoning. Specimen presented by Mr. Couper from the London Hospital.*

Sections of the optic disc show it to be level with the neighbouring retina, which however extends in all the specimens but a very short way. In the centre of its vitreous surface there is a triangular space superficial to the blood vessels, separated from them only by a very thin layer of tissue besides their own very thick walls, and filled up to the general level by loose fibro-nuclear tissue. The fibrous tissue of the lamina



cribrosa is very conspicuous, and rises much higher than usual, its fibres being well marked much above the choroidal level. The fibrous sheath of the optic nerve is very thick, and the fibrous tissue in the nerve is very abundant, the nerve bundles being apparently encroached upon so as to be quite varicose in appearance. The whole brain was quantitatively examined by Dr. Tidy, and  $\frac{1}{40}$ th per cent. of lead was found, making 5 grains in all.

601. *Examination of an Eyeball presenting several interesting medico-legal points.*

Walter B., æt. 11, a healthy boy, left eye excised by Mr. Couper, September 28, 1875. Nineteen days before excision, while standing, probably facing at right angles to a farmer who was rabbit shooting, a shot entered his left eye.

At the date of excision a wound was found a little on the inner side of the left corneal centre, with a bulging of soft lymph from it. The vitreous was gelatinous and semi-opaque, and just commencing to suppurate, and in it near the yellow spot a clot of bright red blood was seen. Close to this the retina was closely adherent to the vitreous and to the choroid, and here an eyelash with a perfect root was found imbedded. The posterior part of the vitreous separates readily from the retina, except at the yellow spot, and in front on the ciliary processes just below the entry of the shot, lymph and blood clots are seen, and in them a small shot was found. The posterior part of the retina was mottled with purplish hæmorrhages, and blood was between it and the choroid. The iris, cornea, and lens capsule are adherent at the seat of wound, but elsewhere free. It would seem as if the shot had rebounded from the back of the eye to its position on the ciliary processes. It is flattened to about half its proper diameter; one side is grooved slightly, and several well marked striæ run in the direction of the groove. There are also two small pits in the groove, one of which is rather lighter in colour, as if it had a lining of finely divided particles of stone. No evidence was called on this subject, but the facts above stated would seem to justify the defence that the shot glanced off from a stone. The verdict was for the plaintiff.

606. *Glioma of Retina extending outside the Globe.*

Lizzie Bland, æt. 3, under care of Mr. Bowman.

She is said to have always been blind of the left eye, and this has become more prominent during the last twelve months. Its cornea is thick, yellow, and semi-transparent, and from its margin the thickened yellow conjunctiva extends backwards. In this are seen tortuous veins and numerous points of ecchymosis.

Extending back on the upper and on the inner side for about four lines, and below for about two lines, tolerably healthy looking sclerotic is seen, but on the outer side it soon becomes ill-defined and covered by tumour mass. The tendons of the superior, external and internal recti can alone be distinctly made out. Behind the globe is a soft faintly lobulated brain-like mass ill-defined from the tissues behind, and through it the optic nerve makes its way backwards as a thin band, whose circumference is indistinctly defined from the tumour substance. From the corneal centre to the posterior part of the tumour, which is here torn away, measures twenty lines. The antero-posterior diameter of the part included within the cornea and sclerotic is 10·66 lines. A longitudinal vertical section shows the lens to be represented by a calcareous scale lying immediately behind the cornea. Behind this is a thick black pigment layer close to the scale in front, but as it passes backwards separating a little from the sclerotic above and below and more behind. Here it ends in a tubular prolongation which soon loses its pigment and becomes less distinct, but still appears to extend to the optic disc. The sclerotic near the disc and on its outer side is thin, being represented by detached though strong fibrous bands. Elsewhere it appears to be of the normal thickness and consistence. The central enclosure formed by the black pigment layer is about the size of a haricot bean, and is filled up by gritty matter, which in front is dry and hard, whilst behind it contains mixed with it softer material more like the mass behind the globe. Between the black line and the sclerotic the same material exists, but here it is of about the consistency of cheese and tougher than elsewhere. The hard dry part contains small uniform sized cells, generally irregular, but approaching oval in shape and sometimes drawn out abruptly into short fine

fibres at their ends, and containing numerous granules and one or more dot-like nuclei. These are mixed with much granular, apparently calcareous matter, and some crystalline plates of cholesterine. Groups of much larger cells of a very faint outline, and each containing a bright vesicular nucleus, can occasionally be seen. Between the pigment line and the sclerotic are found the small cells above described, and the mass behind the globe presents the same structure. The black line representing the choroid and iris shows some moderately dark branching pigment cells mixed with the same small cells. The space enclosed by the pigment layer measures in its vertical diameter 5·66, and in its antero-posterior 4·5 lines. The tube extends back an additional two lines.

609. *Microscopical examination of an Eye lost by recent injury, but showing abundant old Choroiditis Disseminata. Similar disease in other Eye. No cause proved.*

George W., æt. 45, married, farm labourer, living at Mitcham, under care of Mr. Bowman. The left eye was excised on October 8, 1875, on account of suppuration of the cornea from a blow with a piece of wood two weeks ago. A big florid man, with blue eyes. His fauces are red, and he says that he is subject to hoarseness. He is very deaf, and this he says dates from his boyhood. Ophthalmoscopic examination shows similar patches to those described below in the fundus of the right eye; its sight is imperfect. Four or five years ago he saw double, and after that the sight went a little, but he paid no further attention to it. He denies ever having had any venereal disease or any rash. There is a wound in the cornea of the left eye, the lens is clear. The vitreous separates readily from the posterior part of the retina, the optic disc is indistinct in outline, and the neighbouring retina has scattered over it greyish-white patches, which in places are mottled with pigment; near the equator the patches are more pink in colour, with a great amount of dotted pigment over them. At their margin the pigment is more thickly accumulated. Sections through the optic disc, &c., show the optic nerve to be normal, and the tunics near it not to be different from their normal condition. Specimens from the periphery, extending from tolerably healthy retina into a patch of exudation, show the

pigment epithelium of the retina ceasing abruptly, being here apparently of the same thickness up to its cessation, though other specimens show it thickened before it stops. Simultaneously with it, the rods and cones disappear, and the outer granule layer goes only a minute distance beyond it except as a very thin scattered layer of ill-defined nuclei. The inner granules, nerve cell, and nerve fibre layers go on as usual, but in both the nerve cells and fibres the nuclei are few and not well marked. In the chorio-capillaris, where the pigment epithelium of the retina ceases, the vessels seem diminished in number and size, and round some of them a vast number of stained nuclei is aggregated. Here the choroid is perhaps a little thicker than elsewhere and contains at least as much pigment as usual in its outer layers. Further on in the diseased patch, the choroid seems thinner and less pigmented, especially in its inner part. Another specimen shows the choroidal atrophy more advanced, for in the thin retina there are no nerve cells, no nuclei in the nerve fibres, no outer granule layer, no rods and cones nor pigment epithelium. The choroid is also thin. Its inner layers exhibit scarcely any other structure than a very obscure fibrillation parallel to the surface in what appears to be a structureless, colourless, unstained mass. In the outer choroidal layers are a few elongated feebly pigmented cells with their long axes parallel to the surface.

612. *Examination of a case of excision diagnosed as Vesicular Keratitis.*

Henry T., æt. 32, married, a pallid looking man, baker by trade, under care of Mr. Soelberg Wells. The eye was excised during Mr. Wells' absence by Mr. Lawson.

In 1868 a customer drew his attention to something white on the right eye, and on testing it he found the sight misty. He attended a hospital and was told to come again in twelve months' time, for the removal of the cataract. When he went back at the end of that time he was needled twice. Afterwards he could see to read the paper with a glass, but the sight quickly faded, and in some months he could scarcely tell the position of the fire. Lately he has had slight irritation in the eye as if

from dust. Since this came on, he has had over the other a feeling of weight together with some lachrymation and dimness of sight in it. He has been married 9 years, his first four children died in infancy, the youngest born, a month old, is now the only one alive. In 1869 and 1870, between the second and third children, his wife had three miscarriages, each at about three months' date. He denies any venereal disorder. On excision the tension was increased; the iris tremulous, pupil moderately dilated and irregular, the lens represented only by some gelatinous remains in the periphery of the lens capsule. The front wall of this is a web-like membrane. The sclerotic is thin, especially at its periphery. The vitreous is fluid except near the ciliary processes. Optic disc deeply cupped; towards the yellow spot a white crescent extends a little way from the margin of the disc, the free boundary of which is not quite defined.

Sections through the cornea, &c., show its epithelium running inwards a little way from the sclero-corneal junction, and then becoming a little raised from the subjacent tissues. After tapering a little, the epithelial layer ends rather abruptly; then for a little distance we have the proper corneal tissue exposed, and its surface is a little eroded and irregular. After this the sharp outline of Bowman's membrane is again seen to limit the cornea proper, and soon patches of epithelium, thinner, however, than normal, are again seen. The arrangement of the fibres of the proper corneal tissue is very loose. The same appearances are presented in all the specimens.

Sections through the cupped disc and neighbouring tunics show that it is overhung on its inner side, and that the excavation extends not only inwards but forwards, beyond the level of the posterior margin of the overhanging part (*i.e.*, the overhanging lip is bent downwards into the cup). The centre of the cup is deepest, the side towards the yellow spot is rather shelving. Directly below it, the fibres of the lamina cribrosa are well developed. Towards the yellow spot, corresponding to the white crescent, the choroid, which has been up to this point thick and full of large blood vessels, ceases as it nears the disc to have much pigment in its stroma. The pigment retinal layer disappears about the same place, and the rods and cones too become indistinct, and the exterior of the retina comes into



contact with the interior of the choroid without any distinct line of demarcation between them. More peripheral sections show the distal ends of the rods of the membrana Jacobi to be club-shaped and granular.

613. *Fibrous tissue formation in the interior of the Choroid.*

Esther W., æt. 65, married, left eye excised by Mr. Wordsworth, October 13, 1875. Eighteen years ago she had an attack of inflammation with aching pain in the left eye. The sight failed and continued to go gradually till twelve years ago, when the eye could only perceive shadows. For the last four or five months she has had much pain in it. The right eye suffered with pain and dimness of sight eight years ago; an iridectomy was done here, which relieved it, but lately the pain in the left has caused irritation in the right.

The left globe is now shrunken, its cornea is semi-transparent, flocculent opacities are visible in it. The retina, soft and semi-gelatinous, is detached into an umbrella shape. The fluid between the retina and choroid contains numerous cholesterine plates. The choroid is lined by a bluish-white tough layer, which is absent in places, giving it the appearance of being punched into holes. Sections show the sclerotic thickened and its fibres and nuclei arranged irregularly. On its inner side are a great many spaces generally either round or oblong in shape, but sometimes irregular. Some are probably sections of large veins, but others appear to be made by the giving way of the tissue which here consists of cells about the size of white blood corpuscles, round, nucleated, and sometimes pigmented, with between them a very scanty obscurely fibrillated tissue. Internal to this, fibrous tissue, having the appearance of fusiform fibres with elongated nuclei, is arranged parallel to the choroidal surfaces, and still internally the fibres are more distinct and definite. Some appear to have within them nucleated cells, one fibre apparently containing several.

614. *Pigmentation and atrophy of Retina in an Eye lost for many years in consequence of a perforating wound. One quadrant of the Retina remaining unpigmented and less atrophied than the remaining three-fourths.*

John R., æt. 42, married, engine driver, a rather pallid man, under care of Mr. Hutchinson. His sight was good till twenty-two years ago, when a chip of iron wounded the cornea and lens of his left eye. It was early removed by Mr. Critchett, and after that the eye could perceive shadows for some years. He does not know when it lost this power, but now it has no perception of light. He occasionally has felt a little pain in the eye, but does not know how often or for how long. Fifteen months ago he found the inner part of the field of vision of the right eye dim; three months after this the eye received a blow of a fist, causing pain, which ceased under treatment, but the sight got worse, and this continued till admission here, when all things appeared smoky. V. =  $\frac{2}{0}$ ; reads J. 16 at 12". From the upper part of the left cornea a scar extends downwards and a little inwards. The iris is tremulous, except where it adheres to the scar. It is thick, greyish-white in colour. A red reflex only is visible from the fundus. The globe is normal in size and tension. In the region of the yellow spot is a small staphylo-matous thinning of the sclerotic. On an equatorial section, the sclerotic is seen to be thin, though less so than at the yellow spot. The vitreous is fluid and clear, and a calcareous scale represents the lens. The choroid is lighter coloured than usual, and its veins are very distinctly seen. The retina is *in situ*. That quadrant of it which extends outwards from the optic disc and includes the yellow spot, has a moderate supply of blood vessels from its side of the cupped disc, while to the other three-quarters of the retina the vessels are extremely small; while the first mentioned quadrant is about normal in colour, all the rest is minutely dotted over with coal-black pigment. The ciliary processes are in their posterior part almost entirely devoid of pigment.

Microscopic sections of the unpigmented retina show the rods and cones to be present, though they are generally short and clubbed at their ends. Inside this are the two layers of granules, but thinner and much more faintly stained than usual; inside

this again a very few small nuclei, probably of nerve cells, can be seen, and a faintly longitudinal fibrous arrangement may indicate the nerve fibre layer. The fibres of the connective tissue framework of the retina are seen ending at intervals on the internal limiting membrane. Where blood vessels are cut through, their walls are quite free from pigment. Sections from the parts dotted with pigment show no rods and cones, the granules loosely and irregularly arranged, but two layers are roughly distinguishable; from among the granules a few marked but irregular framework fibres run to the inner retinal surface, but no traces of nerve structure can be made out. Where blood vessels are cut through, which is generally near the inner retinal boundary, we see them surrounded with a thick somewhat irregular deposit of coal-black pigment. Their lumen presents sometimes a definite cavity, but frequently appears as if filled up with some structureless material.

658. *Case of fungating Tumour of the Cornea protruding between the lids.*

Joseph G., æt. 67, left eye excised by Mr. Hutchinson, January 17, 1876. A tolerably healthy looking well nourished man, partly lame from the effects of morbus coxæ in childhood. His account is that three years ago a red speck was noticed on the white of the left eye, just like the prick of a pin, beyond the outer corneal margin nearly as far out as the canthus. In six or seven months it turned dark in colour. Still steadily growing, but giving him no trouble, it bulged in two and a half years longer, *i.e.*, three months ago, forward between the lids. For the last twelve months there has been no perception of light, and the tumour has occasionally, but more often during the last three months, dropped a little blood. There is no tumour history in his family. He has had five children, three of whom are alive, one died in infancy in a fit, and one of pneumonia in childhood.

The whole globe was removed with the galvanic cautery. On a vertical antero-posterior section, the cornea is seen to have a greyish vascular somewhat lobulated, occasionally faintly pigmented tumour mass springing from its anterior surface, the whole being  $\frac{1}{4}$  inch in thickness uniformly. This thickening

extends backwards about one and a half lines beyond the sclero-corneal junction above and below, and rather more laterally, and ends as a rather overhanging collar of tumour. In this the thick gelatinous looking conjunctiva makes its appearance, and extends on the sclerotic about a line further back, and then becomes the palpebral fold. The lateral overhanging tumour mass is rather more lobulated, and its conjunctiva is thinner than elsewhere. It has on it large tortuous blood vessels. Behind the cornea is a reddish gelatinous substance filling the anterior chamber, extending outwards, and occupying the region of the ciliary body. Behind this is a definite dark pigment layer, absent at the situation of the pupil, and folded beyond the corneal margin where it becomes the ciliary processes. Behind this black line is another thin layer of reddish material, which above is whitish-yellow, and rather purulent looking. Posterior to the collar of tumour the pigment and other layers cease, leaving the sclerotic bare. In the neighbourhood of the optic disc, some remains of the choroid radiate out from it, and on these are two more patches of the reddish looking material. Elsewhere the sclerotic is bare inside. Its thickness is much as usual except below, where it is very thin and seems to be perforated. This may have occurred during the removal of the eye, and the thin yellowish fluid that then escaped may have come from the interior of the globe through this aperture. Behind the eye is a quantity of fat mixed with muscular tissue, and in this the hard optic nerve makes its way backward. No trace of any other tissue can be detected; microscopic sections show the tumour near its free surface to be made up of large generally oblong nucleated cells, with a few fibres intermixed with them. More deeply towards the cornea the nucleated cells are much smaller, and the fibres seem as if prolonged from the corneal tissue. The cornea can be distinctly seen of nearly its usual thickness, but between the fibres of its lamellæ are rows of the same small nucleated cells. Behind the cornea the situation of the anterior chamber is filled with a fine network of fibrous tissue crowded with the same small cells. Then a distinct line of pigment cells, about the thickness of the uvea is met with, and behind this the same arrangement of a fine network crowded with cells. In the material described as occupying the anterior chamber a very few faintly pigmented cells are scattered.

Fragments picked from the nodules on the remains of the choroid near the disc show moderate sized cells of very faint outline containing a scarcely visible nucleus and some fine molecular matter. The structure here more approximates to that of the free anterior surface of the tumour. No tumour matter is found near to the spot where the sclerotic seems to be nearly or quite perforated.



# A Periscope

OF

## OPHTHALMIC LITERATURE.

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### PART I.

A CALENDAR OF PAPERS ON THE APPARATUS OF ACCOMMODATION CONTAINED IN THE LIBRARIES OF THE ROYAL SOCIETY, THE ROYAL COLLEGE OF SURGEONS OF ENGLAND, AND THE ROYAL MEDICAL AND CHIRURGICAL SOCIETY, DOWN TO THE YEAR 1873.

BY J. W. HULKE, F.R.S.

THE publication of two papers on the "Sense of Sight in Birds," with particular reference to the muscular apparatus of Accommodation, by Dr. J. R. Lee, in the Proceedings of the Royal Society, vol. xx, led me to examine for my own better information every article bearing on the Mechanism of Accommodation which I could find in the above-mentioned Libraries. At the beginning of this inquiry, I had a very inadequate idea of the greatness of the task. As the work advanced it became more and more apparent to me how useful a complete bibliography of the subject would be to anyone about to begin original researches in it. The intrusion of other, necessary, work has prevented my accomplishing what I had undertaken; I now offer for the Periscope this Calendar in its incompleteness, in the hope that it may incite some younger workers to take it up and complete it to the present time.

The arrangement is chronological. A short precis and illustrative extracts follow each title. In translations the *ipsissima verba* of the author are closely reproduced, even at the cost of some degree of uncouthness; this course appearing to me to be preferable in dealing with a scientific subject to a free and less rugged rendering, in which some shade of meaning might be warped or lost.

I have not found an earlier writer on Accommodation than Kepler, cited also by Thomas Young in his historical sketch as the first who scientifically treated this subject. To this illustrious man belongs the great merit of having first successfully

applied the general laws of dioptrics to the physiology of sight, and clearly explained the formation of retinal pictures of external objects. His misconceptions of the mechanism by which Accommodation was brought about were inevitable in the ignorance of the finer anatomy of the eyeball which then prevailed.

1611. KEPLERI. DIOPTRICE ET PARALIPOMENA AD VITELLIONEM.  
ANNO 1611.

The author recognises the necessity of a variation of the relative positions of the lens and retina for the distinct vision of near and of remote objects; and he supposes these changes to consist in an advance of the retina towards the lens, and in its recession from it, dependent on a change of the shape of the eyeball which is produced by traction of the ciliary processes upon its inner surface, and by the extension of these processes by the opposing agency of the tunica uvea. The following extracts fully illustrate his views.

Prop. LXIII.—“It is not possible that the retina whilst retaining the same position in the eye, can be distinctly painted as well by near as by remote objects. For by Prop. XL rays from remote points meet sooner behind the lens than do those from nearer points. But already by XLIII an accurate picture is formed (only) in the meeting point, (of the rays,) therefore beyond the meeting point a confused picture is formed, wherefore also by XL sight is indistinct. In the place where near things are accurately painted, in that place does not occur the meeting of rays from remote points; in the same place, therefore, remote things are painted confusedly, and *vice versâ*, and consequently in that position of the retiformis tunica with regard to the lens, in which we see remote things distinctly, in the same position of it we see near things confusedly.”

Prop. LXIV.—“Those who see near and also remote things distinctly, have an eye healthy and its figure mobile. For since, by XLIII, the retina cannot in the same position be equally painted by both, and yet in those persons who see both distinctly, it is equally painted, (XL XLI,) the retina, therefore, with respect to the crystalline humour, or the crystalline humour with respect to the retina, is moved from its place. And this seems probable, that the healthy, active, youthful eye, as it has a manifest natural movement anteriorly in the pupil of contraction in much light and of dilatation in less, so also behind the lens, in the retiform tunic, it should have the same faculty, so that it may dilate its cavity, by which the fundus (oculi) may be drawn towards the lens if remote things are to be seen, and in turn may contract its cavity that the fundus may recede if near things are to be inspected.”

“Does this natural motion reside in the tela aranea or arachnoid tunic (capsula lentis) which holds the lens of the

crystalline humour fixed in its centre, and which connects it with the uvea by means of black rays emitted on every side? For these black rays, called ciliary processes, are seen to be, combwise, so distinct, that as regards itself anyone of them may be distinct and as it were a peculiar particular muscle. All which (processes) simultaneously retracting into themselves, and so made shorter, this, as it were, diaphragm of the eye, being narrowed and the sides of the eyeball being contracted, renders the figure of the eyeball somewhat oblong or ellipsoid, under which circumstances the fundus or retiform tunic recedes from the crystalline humour. But the ciliary processes in the tela aranea being attenuated, and so extended in length, the circle described by the sides of the eyeball is enlarged, and the eyeball acquires a more lenticular figure, the fundus of the retiformis approaching the lens through the agency of the same uvea which also contracts and relaxes the pupil. In order that this may be effected, the humours, excepting the crystalline lens, are fluid and compressible."

In a foot note to the above, K. refers to a figure, and to a description of an imaginary section of the human eye by Platerus, in his treatise, *De Corporis Humani Structura et Usu*, 1583. Pl. xlix. P. puts the iris midway between the cornea and lens, and he represents the ciliary processes by a couple of parallel straight lines, produced directly outwards from the tela aranea at the equator of the crystalline, through the circumference of the iris to the junction of the cornea with the sclerotic.

1632. PLEMPIUS. VOPISCI FORTUNATI PLEMPHII OPHTHALMOGRAPHIA. AMSTERDAMI, ANNO MDCXXXII. LIBER III, CAPUT IX, P. 169. DE OFFICIO LIGAMENTI CILIARIS.

P. notices Galen's idea that the ciliary ligament serves to attach the retina and convey nutriment, and compares it to the pupil, assigning to it a similar motion for the purpose of approximating the retina to the lens.

"And indeed it (*the ciliary ligament*) appears to me to subserve vision in a twofold manner: in the first place, by its blackness it pours darkness on the inner chamber of the eye, for they (*the ciliary processes*) are black threads so enclosing the crystalline as to form there, as it were, another pupil. Secondly, and principally, by its contraction or relaxation by turns advancing the retiformis tunic towards the pupil or removing it backwards from it."

Page 170. After giving Kepler's theory of Accommodation *literatim*, he continues:—

"Moreover, the retina is soft and flaccid and easily extended, wherefore I should rather say that it is moved than that the crystalline humour itself is either flattened or rendered globose by the said ligament, as some will have it, because it (*the liga-*

ment) is much too delicate and fine, that it could, by its contraction impart to that harder humour another figure."

1652. SCHEINER. OCULUS. HOC EST FUNDAMENTUM OPTICUM. LONDINI, 1652.

S., a member of the Society of Jesus, in this book discusses at some length many questions bearing on physiological optics, and in particular the faculty of Accommodation. His experiment, in which a small object viewed through a pin hole appears single only when the eye is rightly accommodated for its distance, has become the basis of many optometers. He regards the ciliary processes as the active agents of Accommodation, so, with some minor differences, he in the main adopts Kepler's views.

"In these processes," he says, "a certain force appears to reside of constricting the entire eyeball and of relaxing it, of unfolding and folding together the uvea, of protruding and drawing back the lens."

1656. DES CARTES. RENATI DES CARTES, OPERA PHILOSOPHICA. EDIT. TERTIA. AMSTELODAMI, ANNO 1656.

C.'s idea is that the lens is contractile, and through the ciliary processes, as tendons, it constricts the eyeball equatorially, lengthening it axially and changing its whole figure. Priestley in his "History of Optics" has wholly mistaken C.'s theory.

Referring to their representation in an ideal section of the eyeball, C. says of the ciliary processes, "they are numerous black filaments, on all sides around the humour &c. (*the lens*), taking their origin from the second membrane in the place where the third ceases, which bear the appearance of very slender tendons, and through their agency this humour (*the lens*), according as our sight is directed to near or to very remote objects, now more gibbously curved, now more extended in a plane, changes the whole figure of the eyeball. Which experience also confirms. For if any writing is brought close before the eyes of a person very intently regarding a tower or very remote hill, he will not be able to recognise a letter before their figure (*that of the eyes*) shall have become slightly altered."

1669. MOLINETTI (ANTONII) DISS. ANAT. ET PATH. DE SENSIBUS, ETC. PATAVII. MDCLXIX.

M. ascribes Accommodation to a variation of the shape and of the position of the lens, associated with a change of the figure of the eyeball, alterations which are effected by additional and more complete agencies than those mentioned by his predecessor. He is not always easy to understand, partly from our

ignorance of his ideas of the form of the tela aranea (lens capsule) and of its relations to the parts around it, and to the lens inside it, which he seems to think floated in the capsule with some freedom of movement.

Page 18. "But since the incidence of the rays proceeding to the lens is not the same from near as from remote objects, on this account neither is the refraction the same, nor have they their meeting point in a point equally distant from the lens, nor has the lens a fixed position, nor can the same distance from the formal organ (*of sight*) be assigned to it.

"On this account it (*the lens*) has the faculty of approaching the retina and of receding from it, but not without an alteration of the whole eyeball, and, suspended by the ciliary ligament, of moving slightly to and fro, so that the point of collection (*of the rays*) might touch a distinct part of the retina and excite it in the requisite degree. And the way is this—there where the ciliary processes fix themselves, the globe of the eye, which is nearly spherical, laterally contracted, extends in length, and so the fundus oculi, and the retina with it, is removed from the lens. The contrary indeed occurs when the muscles outside contract themselves, because then the globe of the eye pulled laterally is on all sides dilated, and since the space from side to side then greatly exceeds that from the pupil to the fundus, the crystalline and the retina necessarily come nearer, either the crystalline approaches the retina or this latter advances towards the crystalline. But not content with this contrivance, nature has joined another, as an auxiliary, to wit, the combs of the ciliary processes, to the border of the interior of the arachnea, with which tunic encircling the lens, nature has so joined them, (*i.e. the ciliary processes,*) that, arranged combwise, as often as they contract themselves the more elevated part of the inner surface (*of the arachnea*) is forced to extend (*itself*) towards the circumference, and so to become depressed, and the whole to become flattened, and adapted to the proportion of the outer surface. By which arrangement, because a flat lens easily emits rays at greater lengths than one raised in a prominence, it easily directs the point of the inverted cone (*of refracted rays*) vertically to the retina however distant this may be."

Molinetti, then, opposes the contraction of the external muscles to that of the ciliary processes, the first shortens the axis of the eyeball, the second lengthens it, and removes the retina from the lens. He also supposes the contraction of the ciliary processes to flatten the lens by their traction on the equator of its capsule for the purpose of adopting its dioptric powers to its greater distance from the retina.



1764. BARTHOLINUS. ANATOMIA BARTHOLINA. LUGD. BAT. 1674, LIB. III, DE CAPIT. CAP. VIII, DE OCULIS.

B. seems to have been uncertain whether the ciliary processes were active or passive agents in effecting Accommodation. He plainly doubted their muscularity.

"From the circumference of the uvea, where its folded membrane reflects itself upon the crystalline, arises a ligament, or as it is called the ciliary interstice, which consists of certain slender filaments produced from the uvea, resembling the black cilia of the eyelids, and which surround the crystalline which through their means is connected with the neighbouring parts, and is moved together with the mobile uvea. Cartesius regarded them as slender tendons. Perhaps they are small lymphatic vessels. Nevertheless their office is to move the crystalline so that its position may be changed for the various requirements of sight, and its figure may become either more convex or flatter."

1680. PERAULT. LA MÉCANIQUE DES ANIMAUX, À PARIS, 1680.

P. likens the eyeball to a prospective glass, and he thinks that Accommodation is produced by variation of the interspace between the lens and retina due to changes in the axis of the eyeball, which are brought about by muscular pressure and relaxation.

1 Partie, p. 45. "—— the ciliary ligament which supports the crystalline, takes the place of the ring which holds the glass. Lastly the contrivance by which the prospective glass is lengthened and shortened according to the different distances of objects wished to be viewed, is only an imitation of the faculty which the eye has of being lengthened by the compression of its muscles, or shortened by their relaxation, of bringing the crystalline nearer to the retina for the purpose of placing it at the requisite distance, so that its focus may coincide with the surface of this tunic."

1680. TYSON. ED. PHOCÆNA, OR THE ANATOMY OF THE PORPESSE DISSECTED AT GRESHAM COLLEGE, 1680, LONDON.

T. suggests that in this cetacean the musc. suspens. may subserve Accommodation by compressing the sclerotic. He seems to have disregarded its attachment behind the equator of the eyeball, and the great thickness of this segment of the sclerotic.

Page 38. "The use of this in brutes that are pron. capite., is thought to be to suspend the bulk of the eye that it receives no injury from the declivity of the head, but there not being that danger here, nature, that does nothing in vain, must have some other intendment, and probably it may be, that by its equal

contraction of the sclerotic, to which it is fastened, it renders the eye more or less spherical and so fitter for vision."

1686. BOHN. DR. JOHANNIS BOHNII. CIRCULUS ANAT. PHYSIOLOGICUS. LIPSIE. MDCLXXXVI. CAP. DE VISIONE.

B. discusses and rejects the theory that Accommodation is directly affected by a variation of the shape of the whole eyeball, produced by the pressure of the simultaneously contracting external muscles. He thinks it consists in increased convexity of the cornea, a forward movement of the lens towards the iris and of the retina towards the lens, which are effected by the pressure of the freely mobile vitreous and aqueous humours derived by these through the ocular tunics.

Page 423. "Because not less the different distances of objects from the eye, and the diverse intensity of light, very greatly diversify sight, so these organs see by means of a peculiar mobility, through the instrumentality of which the crystalline is sometimes brought closer to the retina, and sometimes it recedes from it.

"In their explanations of the reason, and of the method by which this alternating elongation and contraction of the eyeball takes place, authors differ. For there are some who say that the crystalline humour recedes a little from the retina, if the muscles of the eyeball, collectively—or at least four of them, the *musc. recti*, which singly move the eye in opposite directions—contracting simultaneously, and hence become shortened and swollen, compress the sides of the eyeball, hence lengthen it outwards. Others, again, assign this office (that of compressing the eyeball) to the two *musc. obliqui* alone; these simultaneously contracted in the vision of a more remote object, as it were protrude the lens from the retina, lest the apex of the refracted cone (*of rays*) should be lengthened beyond the retina; the others (*muscles*) they say rather flatten the eyeball. But because the contractile power of all these muscles appears to be much inferior to their bulk, this explanation of the elongation can scarcely be conceded, and with the contraction of their fibres, of necessity, the eye will be more flattened, or its mobile anterior part, to which the muscles are attached, may approach the fundus, and thus the sides of the eyeball might scarcely feel their (*the muscles*) swelling, or have been compressed by this to such an extent, whilst they impel forwards the aqueous and vitreous humours, to which the lateral spaces, so dilated, yield room; hence they may render the eyeball protuberant, and at the same time raise the lens. Much less can anything in this process be assigned to the contraction, as such, of the *musc. obliqui*, because the *trochlearis* has the same origin as the rest; nor can the other, as it arises from a peculiar foramen of the orbit, render any service of this kind, equally retracting.

Neither is anything to be expected from their pressure, for the reason assigned, so that I may be silent, only the narrower parts of the eye, drawn by these very slender muscles, are compressed, but the wider parts of the parietes of the same are dilated.

“Concerning, therefore, the motion of the parts of the eye, my idea is this, that the whole eyeball is shortened somewhat by these muscles acting in unison, but the cornea will be raised and become more convex, through the instrumentality of the aqueous humour driven upon itself, and, as it were, expressed into the space underlying the cornea, and out of reach of the tendons of the muscles. This, however, cannot happen without the crystalline at the same time moving nearer to the pupil, raised, not alone, but together with the vitreous. Because both the one and the other of these humours are connected by a common tunic without the laceration, or the painful stretching, of which the crystalline cannot be separated from the vitreous: nay, these cannot alternately recede from one another, unless an empty space, or one filled with some kind of fluid, should intervene, whence a new divergence of the rays refracted towards the perpendicular in the lens might happen, greatly confusing vision. The vitreous humour itself, indeed, because it is soft and most dilatable, is doubtless somewhat flattened by the compression of the eyeball, and so far loses somewhat of its thickness, and consequently the crystalline approaches closer to the retina.”

1676. BRIGGS. OPHTHALMOGRAPHIA. 1ST EDIT. 1676,  
(2ND EDIT., 1687,) LONDINI.

B. thought that the musc. recti flattened the eyeball, and the musc. obliqui lengthened it, for viewing near and remote objects.

Page 11. “It is probable that the four recti contracted in unison flatten the eyeball or bring the crystalline nearer to the retina in the vision of near objects, where the optic pencil is shorter; the musc. obliqui, on the contrary, acting together lengthen the eye, or push the lens away from the retina in the vision of remote objects, lest otherwise the refracted cone might be extended beyond the retina.”

1696. RUYSCHIIUS. EPISTOLÆ PROBLEMATICÆ. AMSTELÆDAMI.  
(A REPLY TO WEDEL.)

R. did not doubt the contractility of the ciliary ligament.

Page 15. “Farther, that the ciliary ligament consists of motor fibres I have no doubt, for movement is clearly perceivable in their processes, and this in dilatation and diminution of the pupil. But whether besides these said ridges, peculiar motor fibres may be found in the ligament itself I have not yet ascertained.”

1703. LA CHARRIÈRE (JOSEPH DE). ANATOMIE NOUVELLE DE LA TÊTE.  
PARIS, MDCCIII.

La C. thinks that Accommodation is effected by variation of the shape of the eyeball, and also by movements of the lens and of the pupil. These alterations are brought about by the musc. recti, and by the ciliary ligament.

Page 335. "There are only the alterations of the figure of the eye, and the different movements of the crystalline and of the pupil, which can render the sight of the eye more distinct."

Page 271. "When these muscles (*four recti*) contract themselves in unison the eye widens, and flattens itself slightly in becoming shorter."

Page 277. "This ligament is named ciliary because the tubes which form it are as fine and even more slender than the eyelashes."

Page 282. "It seems really that all the parts of the eye are destined for its (the lens) preservation, the muscles by their several movements impart to it whatever direction we please, and dispose the ciliary tubes by their swelling to recede from the retina or to approach it according as they are excited by a movement of the light."

1719. PEMBURTON, HENRICUS. DISS. INAUG. DE FACULTATE OCULI QUA  
AD DIVERSAS RERUM CONSPECTURUM DISTANTIAS SE ACCOMMODAT.  
LUGDANI, 21 JAN., 1719.

P. appears to hold, that in Accommodation the shape of the cornea remains unaltered, and that the form of the lens is varied. He doubts whether the eyeball could be flattened by pressure against the bottom of the orbit without disturbance of its parts, and he notices its impossibility in animals with very thick sclerotics, *e.g.*, whales.

Caput 1. "First, our concern is with this faculty of the eye, concerning which authors hold two opinions. The majority refer it to the crystalline humour, but there are some who would derive it from another source; to them the four musc. recti moving the eye appear not unfit for this purpose."

Page 4. "Concerning the lens, however, there are two opinions. Some will have it to be moveable from its place; whilst others rather assign to it a variable figure."

Page 14. Prop. 6. "These being proved, it remains to be shown that the crystalline has a mobile figure, if only the tunica cornea maintains its (*form*) unvaried. If this is possible, it cannot be otherwise than that the crystalline preserves its figure, and is only moveable from its place."

Page 24. "Now, truly, from all these (*considerations*) we may finally safely gather only one thing—that the crystalline has a variable figure."

1727. TAYLOR, JOHN. AN ACCOUNT OF THE MECHANISM OF THE EYE. NORWICH, 1727.

T. attributes Accommodation to a change in the figure of the cornea.

Page 28. "The aqueous humour being thinnest and most liquid, easily changes its figure, when either the ligamentum ciliare contracts, or both oblique muscles squeeze the middle of the bulb of the eye, to render it oblong when objects are too near to us."

1742. LOBÉ. DE OCULO. HUMANO. M. HALLER. DISPUT. ANAT. LUGDAN. BATAV. 1742.

L. thought the ciliary processes were muscular, and that they varied the shape of the lens and also slightly shifted its position, (p. 108.)

"The ciliary ligaments, derived from the choroid, pass across the front part of the vitreous humour, in the form of a quaquaversal arch, to the confines of the retina and ciliary circle, to become inserted in the capsule of the crystalline lens. Hence, because their nature is muscular and fibrous, in contracting themselves they lessen its (*the lens*) curvature, and they become straighter. Acting all in unison, the crystalline lens (which is their punctum mobile) will indeed remain in the centre of the eye, but it will be somewhat elevated, and it will approach the cornea. For the anterior and curved surface of the vitreous humour will be depressed by the action of these ligaments, and since on account of the resistance it cannot yield in an upward direction, all pressure accruing thence will be determined towards the more depressed part, that is, to the small pit where there is less resistance, which thus elevated will lift the lens adhering to it. But when the action of the ligament ceases, the vitreous humour restoring itself by virtue of its elasticity, will make the small pit, and together with it the crystalline, subside and cause them to approach the retina."

1744. BOERHAVIUS. PRÆLECT. ACADEM. ED. ET. NOT. ADD. A. HALLER. AMSTELÆDAMI, 1744.

B. supposes Accommodation for a remote object to be effected by pressure exerted by the four musc. recti contracting in unison, which makes the cornea more convex; and adaptation for a near object to be brought about by the lens being shifted forwards by the vitreous humour, which itself becomes denser and more strongly refractive.

Tomus iv, page 255. "For the shape of the eyeball can be changed, when we cannot alter the distance of the object, and



be accommodated for viewing more remote, or nearer objects. This Pemberton has elegantly demonstrated in an inaugural dissertation. Whoever wishes to distinguish upon the sea a sail at a distance of two miles, cannot do so, though he be a very aged man, unless he has so compressed his eye with the four recti muscles as to render its anterior part more convex. This happens so as if a flexible vessel full of water were more strongly pressed in three parts of its circumference, and a fourth part which was weaker was pressed by some cause, for there the less resistant part would swell out. Hence the eye is fatigued when we accurately regard a very remote object, and if you have a friend at hand who makes such an effort, you will see his eye anteriorly become more convex. We do not ignore what Perrault has said against this opinion, that *e.g.*, the whale's sclerotic is almost one inch thick. Exactly so, it however constantly becomes thinner forwards, and the cornea is more than ten times thinner than the sclerotic, so that it is compelled to yield entirely to the compression of the eyeball and the urging humours.

"By contraction. This is the second cause, namely:—the tunica ciliaris is, as it were, an arc, and it rests on the lens in the midst, and on the vitreous humour. When this tunic is contracted it is brought into a straight line subtending the arc of the tunic of the vitreous. At this moment doubtless both the lens is sent forwards, because pressed at its sides it becomes free in the middle, and the vitreous will be pressed backwards, in order that it may drive the lens forwards. These two causes render the eye a moveable telescope which accommodates itself to every distance of objects, and which can alter its focal points. A very clever geometrician has written about this matter, and he holds the lens to be a spiral muscle which can become flatter and more convex, and he thinks that the lamella of the lens may be in turn approximated or separated. This author, truly, assumes many things which cannot be conceded by every one. I, indeed, make use of those things which I find in the eye, and I think that this explanation is sufficient to afford the reason of the phenomena.

"The vitreous. At the time the crystalline is pressed forwards, the vitreous becomes more solid and collects the rays more exactly, and so the focus is collected into the smallest point. Such is the action when we very intently examine an extremely minute object. Nor is much change required for the production of a proper retinal picture of the object."

1746. CAMPER. DISSERTATIO OPTICA DE VISU. 1746.

C. ascribes Accommodation to variation of the shape of the lens produced by contractions of its fibres, aided by neighbouring

external structures, and perhaps the figure of the cornea is slightly varied.

In another treatise, *De quibusdam oculi partibus*, 1746, he discusses and rejects several theories involving a change of the shape of the whole eyeball.

Page 6. "In a physiological dissertation (C.) we have stated every taught method, and have finally concluded that it is probable that the lens changes its form by the aid of fibres placed in its very substance; and since these do not suffice, it is likely that the ciliary circle and Petit's canal assist them further; perhaps the ligaments, it may be very slightly, co-operate. Neither am I also opposed to thinking that the cornea may be slightly changed in form, so (*little*) that it may escape our notice, for it is flexible, and if the others are added only a small alteration is needed."

"That the whole eyeball cannot alter its figure I have demonstrated. Meanwhile, this argument appears to me of no value, namely, that in man this alteration cannot happen because in other animals which yet require the same alteration the sclerotic is found extremely hard and bony."

1748. PLATNERUS. A. OPUSCULA. PROLUSIO XIII. DE MOTU LIGAMENTI CILIARIS IN OCULO. LIPSIÆ, 1748.

P. makes Accommodation consist in an advance of the lens, together with the central part of the vitreous humour, effected by the ciliary ligament.

Page 115. "Others have thought that the lens itself is thinned and rendered flatter, others finally deny both, and more rightly consider that the bag in which the lens floats, as it were free, is moved forwards by this ligament and its arched fibres. At the same time also the anterior prominent margin of the vitreous, by which we know the lens to be surrounded, is compressed. But the vitreous humour is of this nature, that when pressed it somewhat resists, or, as they say, becomes elastic, wherefore whilst its anterior margin is so compressed, its central part, and the lens with it, is pushed forwards and is moved away from the retina."

1748. LE MOIRE (M. SYLVEST. ANT.) DISS. AN OBLIQUI OCULORUM MUSCULI RETINAM À CRYSTALLINO REMOVEANT. PARIS, 17 JANUAR. A. 1743. DISS ANAT. SELECT. HALLERI. GÖTTINGÆ, 1748, p. 138.

Le M. refers Accommodation to a lengthening of the eyeball, concurrently with a removal of the lens from the retina, which is effected by the compression of the eyeball by the musc. obliqui.

"These (the obliqui) two muscles are simultaneously contracted, and the eye which they constrict is lengthened, its width being diminished, and thus the retina is removed from

the lens. These muscles do not appear to have been made for any other use."

1749. BUFFON. DISS. NAT. NOUV. EDIT. RED. PAR SONNINI.  
T. XX, p. 441. PARIS, ANNE viii.

S. makes B. find Accommodation in varying relations of the retina and the transparent parts of the eye.

"Observation has fully confirmed Buffon's opinion. This longer sight . . . . proceeds . . . . rather from an alteration of position between the parts of the eye, as between the cornea and the lens, or rather between the vitreous humour and the retina." B. notices the change which occur in the sight of old persons.

"After the ingenious and delicate experiments of Ramsden, we know that the eye is like an optical glass which is shortened or lengthened, according to the distances of objects towards which it is directed, also adjusts itself, but spontaneously, to the proper form in order that vision may be distinct for the distances, greater or less, at which objects lie. From whence it is reasonable to conclude that the cornea is very elastic, and that this elasticity, combined with the action of the four muscles which reach its borders, changes its figure in order to render it fit to suit all distances. The diminution of the elasticity of the cornea, which is the same thing as its dessication, and the muscles which abut on it becoming less flexible, must necessarily modify sight in a remarkable manner in advanced age." (Sonnini's note.)

1755. LE ROY. MÉMOIRE SUR LE MECHANISME PAR LEQUEL L'ŒIL S'ACCOMMODE AUX DIFFÉRENTES DISTANCES DES OBJECTS. MÉM. DE L'ACAD. ROY. DE SC. 1755.

Le R. would revise La Hire's theory, that Accommodation is effected by variation of the pupil, and does not consist in any alteration of the refraction of the eye. The ciliary processes are not muscular, they float freely in the aqueous humour, and not having any attachment to the edge of the lens they cannot exert any traction on it.

Page 594. "The fibres of which we have just spoken are both by their nature and also by their arrangement wholly improper to execute the movements of the lens ascribed to them. In fact, the ciliary processes do not terminate at the edge of the capsule of the lens, as has been supposed, but they advance considerably on the anterior surface of the capsule, and they float without any conspicuous adherence. Much more, these fibres are not of a muscular nature."

1759. PORTERFIELD, WM. A TREATISE ON THE EYE, EDINBURG, 1759.

P. believed "the eye is adapted to distances by the *ligamentum ciliare*," and this adaptation consists in variation of the distance of the lens from the retina.

Page 436. "It remains now that we enquire what this change of the crystalline is, and by what mechanism it is produced."

"Some maintain that according as objects are at different distances, this humour becomes more or less convex, which does indeed very well account for distinct vision at all distances."

"Others, again, are of opinion that the crystalline never changes its figure, but that it is moved to and fro from the retina, according to the distance or proximity of the object in view; and this does also equally well account for the distinct appearance of objects at all distances. Those that embrace the first opinion, say that the *ligamentum ciliare*, which arises all round from the inside of that circle of the choroides where it joins the uvea, does by its contraction draw the edge of the crystalline, to which it is attached all round, towards that circle, and by that means makes it broader and flatter than before, when objects are at a distance from the eye; and that when we view nearer objects this ligament is relaxed, and the crystalline recovers its convexity by the elasticity of its parts. But if we observe accurately the situation of the *ligamentum ciliare*, we will find that it is such as disqualifies it for rendering the crystalline more flat by increasing its breadth, for its fibres are not in the same plane with the crystalline, but have an oblique direction, and therefore it can never, by its contraction, change the figure of the crystalline."

Page 446. "Now the *ligamentum ciliare* is an organ whose structure and disposition excellently qualify it for changing the situation of the crystalline, and removing it to a greater distance from the retina when objects are too near to us; for when it contracts it will not only draw the crystalline forwards, but it will also compress the vitreous humour going behind it, by which compression it must press upon the crystalline, and push it further from the retina."

1763. HALLER. ELEMENTA PHYSIOLOGIA. TOMUS V. LAUSAUNE, 1763.  
VIDENDI MODUS.

H. thinks that distinct vision of objects at different distances is due to variation of the size of the pupil, and not to a change in the refractive power. He employs Scheiner's experiment to refute the existence of an accommodative faculty.

Page 516. "The reason of the invention of all these hypotheses was that physiologists had believed that man sees distinctly at very different distances, hence they required an alteration in the refractive powers."

Page 517. "Further, it is certain that we see through a card, pierced with two holes, an object single in the point of distinct vision, and in every other point double, a manifest arrangement that there is a certain and definite state of the eye in order that it may distinctly see at a certain distance, but it cannot alter that state so that it may also distinctly perceive at another distance."

Page 516. "The motion of the pupil suffices."

1767. LE CAT. TRAITÉ DES SENSATIONS ET DES PASSIONS EN GÉNÉRALE, ET DES SENS EN PARTICULIER. MDCCLXVII.

According to Le C., Accommodation of the eye for remote objects is effected by shortening of the axis, which is produced by the four musc. recti pulling it backwards against the bottom of the orbit, associated with flattening of the lens and decrease of its refraction. That for near objects he finds in compression and lengthening of the eyeball by the musc. obliqui. These motions are aided by changes in the lens intrinsic and also impressed upon it by the ciliary circle and by the Morganian liquor.

Page 650. "I have stated (p. 495) the action of the four straight muscles of the eye for the purpose of this shortening; these pulling the front of the eyeball towards the bottom of the orbit lined with fat these muscles and nerves, etc., cannot fail to bring the front of the eyeball nearer to the posterior surface, and thereby to render the whole lenticular apparatus which it contains wider, flatter, and less refracting, a condition adapted to lessen the part of the distance to the bottom of the eye, and to cause the image of distant objects to reach the bottom of the eye, already brought closer (*to the lens*)."

"For near objects, whose sharp retinal picture will be painted further off, (*from the lens*,) and for which the eye must lengthen itself, I have already referred (p. 496) this action to the musc. obliqui, which in compressing the eyeball at the equator should shorten it in this region and lengthen it at its poles. But suspecting that all these muscular forces external to the eyeball do not effect a shortening and elongation sufficient for the distances of very near or objects very remote from the eye, I have added to these the alterations of the whole lenticular apparatus, of its interior, as well by the change of the exterior, itself compressed as we have first seen, as by the proper motion of the ciliary circle, assisted by the humour or the water of the crystalline capsule. I have said that this crystalline was brought nearer the pupil and flattened for distant objects, and that it was rendered more convex for nearer ones."



1780. OLBERS. DISS. INAUG. PHYS. DE OCULI MUTATIONIBUS INTERNIS. GOTTINGÆ, MDCCLXXX.

O. discusses at some length several theories of Accommodation, and then advances the hypothesis of a mutual recession of the lens and retina, whilst the cornea becomes more convex.

Page 33. "The true theory of the internal movements of the eyeball."

"The force of this compression, produced by the simultaneous contraction of the four recti muscles, acting upon the vitreous humour occupying the greater part of the eyeball, which, as it cannot recede upwards, or downwards, or laterally, because there the compressing muscles lie near, of necessity protrudes the lens and presses back that part of the (*ocular*) tunics which is not covered by the muscles, *i.e.*, the fundus. Thus the distance of the lens from the retina increases in a double manner, by the former receding and the latter advancing, whilst simultaneously the cornea has been rendered more convex by the compressed aqueous humour."

1786. BLUMENBACH. DE OCULIS LEUCÆTHIOPUM, ETC., COMMENTATIO. GOTTINGÆ, 1786.

B. believed that he had discovered the mechanism of Accommodation in the different thickness of the seal's sclerotic in different regions.

Page 16. "Nor did my hopes deceive me. Inasmuch as I seemed to discover a simple and elegant solution of the problem in the different thickness which the sclerotic exhibits in different regions; namely, that region which immediately follows the very thin cornea is thick and almost cartilaginous, whilst that which succeeds this and which encircles the middle of the eyeball is thin and very flexible; but the remainder which occupies the fundus oculi (which the optic nerve pierces in its very centre, directly opposite to the middle of the cornea and of the pupil) has, lastly, grown so thick that it more than exceeds in hardness the front part which I have called almost cartilaginous. Hence it is very evident that the eye, thus plastic, may be made now shorter and now again longer by the aid of the remarkable muscles which embrace it; so that, according to the requirement of a denser and a rarer medium, the cornea may be rendered now more convex and now flatter, may now be driven more forwards and now more backwards."

1789. ADAMS, G. ESSAY ON VISION. LONDON, 1789.

The author (mathematical instrument maker to the Prince of Wales) thinks that Accommodation is probably effected by varia-

tions of the convexity of the cornea, of the length of the axis of the eyeball, and of the shape of the lens.

Page 77. "Perhaps the cornea and the crystalline, if not some other parts of the eye besides, may contribute to produce this effect; and that in order to obtain distinct vision at a nearer distance, at the same time the cornea is rendered more convex the axis of the eye may be a little lengthened, the crystalline made more convex and brought forwarder, all which changes conspire to the same end; and the contrary for obtaining vision at a greater distance."

1793. YOUNG, THOMAS. OBSERVATIONS ON VISION. MISCELL. PAPERS. FROM PHIL. TRS., MAY 30TH, 1793.

The author after reviewing several theories of acc., describes a fibrous structure of the lens, which he regards as a muscular organ innervated from the lenticular ganglion.

Page 525. . . . "I conceive, therefore, that when the will is exerted to view an object at a small distance, the influence of the mind is conveyed through the lenticular ganglion formed from branches of the third and fifth pair of nerves, by the filaments perforating the sclerotica to the orbiculus ciliaris, which may be considered as an annular plexus of nerves and vessels; and thence by the ciliary processes to the muscle of the crystalline, which, by the contractions of its fibre, becomes more convex, and collects the diverging rays to a focus on the retina. . . . The liquid of the crystalline seems to serve as a synovia in facilitating the motion, and to admit of a sufficient change of the muscular part, with a smaller motion of the capsule."

"The fibres are attached along lines resembling tendons."  
(The axial planes?)

YOUNG, THOMAS. ON THE MACHANISM OF THE EYE. (FROM THE PHIL. TRS., 27TH NOV., 1800.) MISCELL. PAPERS, P. 573. LON., 1807.

The author proves by acrefu experiments that the cornea is not concerned in Accommodation, and that it is highly improbable that any material change in the length of the axis of the eyeball takes place. He found that where the crystalline lens was absent the actual focal distance of the eye was unchangeable, and by well contrived experiments he almost mathematically demonstrated the occurrence of an internal change of figure of the lens, which he attributed to its muscular contraction. He abandons the comparison of the planar extensions of the axis to tendons.

1793. HUNTER, JOHN. THE WORKS OF J. HUNTER, EDITED BY J. F. PALMER, VOL. IV, P. 286. 1837.

This is a paper by E. Home, embodying observations and experiments which Hunter had made to test the muscularity of the lens in preparation of a Croonian Lecture, the delivery of which was anticipated by his death.

In a memorandum (1793) on the adaptation of the eye, H. says, "From all these considerations I can discover no power that could adapt the eye to the various distances of which we find it capable in the human body, unless we suppose the crystalline humour to be varied in figure, which can only be effected by a muscular action within itself."

1797. MUNRO, ALEX. THREE TREATISES ON THE BRAIN, THE EYE, AND THE EAR. EDINBURGH, 1797.

M. attributes Accommodation to a variation of the axis of the eyeball, (produced by the pressure of its external muscles,) associated with a movement of the lens to and from the retina, aided by increased convexity of the cornea, resulting from compression of the surrounding sclera by the orbicularis palp.

Page 137. "Upon the whole, it appears to me:—

"1. That the iris, by lessening the pupil, and by intercepting the most diverging rays of light, renders the pictures of near objects more distinct.

"2. That the recti muscles, by their action, lengthen the axis, because they press chiefly on the sides of the eyeball; and, farther, that the cornea is not only more dilatable than the sclerotic in general is, but it will be found that the sclerotic, in man and other animals, is thinner and more dilatable in its anterior part, and in its posterior part where the picture is formed, than it is on its sides.

"3. That the two oblique muscles forming an oblique girth around the eyeball, between the lens and the bottom of the eye, must, by their pressure, increase the distance of the lens from the retina, or increase the length of the posterior part of the axis of the eyeball.

"4. The orbicularis palpebrarum renders the fore and middle part of the cornea opposite the pupil more convex, and increases the length of the anterior part of the axis of the eyeball. And it is evident that all these means may concur in forming perfect vision."

1813. CRAMPTON, DR. ANNALS OF PHILOSOPHY, VOL. I, ARTICLE III, P. 170. GILBERT. ANN. D. PHYSIK, XLIX, P. 278-288.

The first discovery of an internal muscular apparatus in the ciliary region indubitably belongs to this author, since he first

demonstrated its existence. Earlier anatomists and writers on Accommodation had formed theories involving the occurrence of muscular fibres in this situation, but none had actually verified their presence by dissection. It is probable that Crampton did not distinguish between the anterior muscle which has since borne his name, and the less conspicuous posterior muscular slips subsequently more precisely described by Brücke.

Page 6. "The organ to which I allude is a distinct muscle which arises from the internal surface of the bony hoop of the sclerotic, and is inserted by a tendinous ring into the internal surface of the cornea about one line within its circumference. In order to demonstrate this muscle, it is necessary only to remove the anterior segment of the eye just behind the bony hoop, and then the pigmentum nigrum being carefully washed away, the iris is to be gently detached from the ciliary circle, and the choroid coat from the sclerotica. Some delicacy is necessary in performing this part of the operation, for the muscular fibres adhere to the internal surface of the choroid coat, as well as to the bony hoop; if the choroid be not, therefore, slowly and carefully detached, many of the muscular fibres will be separated from the bone and confounded with the membrane and its pigment.

"When the muscle is thus exposed, its descending fibres will be seen terminated in a well-defined tendinous ring, which advances a little beyond the circumference of the cornea to which it firmly adheres. The thickness of the muscle, as well as the manner of its insertion, may be most conveniently demonstrated by cutting the anterior segment of the eye through its diameter. The fibres will be then seen upon that part of the cut edge which corresponds with the bony hoop. To complete the demonstration, a pen, or a thin probe, may be passed between the muscle and the sclerotica. . . .

"A mere inspection of the attachments of this muscle will be sufficient to suggest its action, for since the bony hoop from which the fibres arise must be considered as a fixed point, the cornea into which they are inserted must be drawn inwards by their contraction."

C. believed that he had demonstrated this by galvanizing the muscle in a turkey's head instantly after decapitation.

"Since, then, it may be demonstrated that this muscle is in its action a depressor of the cornea, it seems scarcely necessary to add that its influence must tend to diminish the convexity of the eye."

Page 173. "It seems probable, therefore, that the eyes of birds are in the ordinary state possessed of a high refractive power; and an eye so constituted seems particularly well adapted to the uses of the animal while it rests on the earth; but when it soars into the middle regions of the air, the rays proceeding from objects below must arrive at the eye in lines which

may be considered as parallel ; consequently to form anything like a distinct image the focal length of the organ must be increased as the divergency of the rays decreases. This adjustment may be perfectly effected by diminishing the convexity of the cornea, and it has been shown that there is in the eye a muscle to which this function may be assigned."

1821. VALLÉE. MEM. SUR LA THÉORIE DE LA VISION, LU À L'ACAD. DES SC. JOURNAL DE PHYS. EXP. PAR MAJENDIE. 1821. T. I. P. 144.

V. finds the mechanism of adjustment in a progressive density of the deeper part of the corpus vitreum.

Mile. "The basis of the new theory of Vallée rests on the vitreous humour having a greater refractive power towards its bottom than near the lens. Whence it must result that the rays proceeding from a single point instead of crossing after their refraction in the eye and forming cones joined at their apices, only make a single one which will not end in a point, but rather in a line. Whence it follows that such a cone may lengthen or shorten itself according to the variable distance of the object, and yet the rays act only on a single point, for the line will only give a point at every section of it at different distances."

1826. MÜLLER. J. ZUR VERGLEICHENDEN PHYS. DES GESICHTSINNES DER MENSCHEN UND DER THIERE. LEIPZIG, 1826.

M. is disposed to find adjustment in variation of the lens caused by the ciliary ligament.

Page. 211. "I am, however, very far from thinking that the alterations of the pupil and of the refractive condition are one and the same. Olbers has refuted this view with mathematical precision. Much rather do the positional changes of the lens requisite for the production of distinct sight at different distances, and which in all can scarcely amount to one line, appear to be conditioned by the ciliary ligament."

1826. MILE. JEAN, DE LA CAUSE QUI DISPOSÉ L'ŒIL POUR VOIR DISTINCTEMENT LES OBJETS PLACÉS À DES DIFFÉRENTES DISTANCES. MAJENDIE'S JOURN. DE PHYS. VOL. VI. 1826.

M., professor of Physiology at Warsaw, rejects all theories involving a change of the shape of the eyeball, as also those requiring an alteration of the position or figure of the crystalline lens, and considers the iris to be the chief factor of Accommodation.

Page. 169. "In fact the membrane of the iris is of all organs enclosed in the sclerotic, the only part which has a distinct movement. Moreover, experiments directly demonstrate that the size



of the pupil changes according to the distance of objects. Are not those evident proofs of a causal connection of the changes in this organ with the phenomena in question?"

1828. TREVIRANUS. VERMISCHTE SCHRIFTEN. BD. III, BEITRÄGE ZUR ANAT. UND PHYS. DER SINNESWERKZEUGE, HEFT I. 1828.

T. thinks that in man's eye no changes except those of the pupil can be proved requisite, and that their pre-supposition is unnecessary.

The nictitating membrane adds to the convexity of the cornea, and in this way is a factor of Accommodation.

T. clearly saw Crampton's muscle, he noticed its cross-stripping, but doubted, notwithstanding this, its muscularity.

1832. ARNOLD. UNTERSUCHUNGEN UEBER DAS AUGES DES MENSCHEN. HEIDELBERG, 1832.

S. 38 und f. Arnold adopts Olber's theory, viz., that by the simultaneous contraction of the four musc. recti the globe is compressed, its axis is lengthened, and the distance between the lens and the retina is increased.

1833. SMITH, TH. ON THE MUSCULAR STRUCTURE AND FUNCTIONS OF THE CAPSULE OF THE CRYSTALLINE LENS AND CILIARY ZONE. PHIL. MAG., VOL. III. 1833.

S. finds Accommodation in variation of the shape of the lens, which is produced by contraction of its capsule and by the zonula Zinnii.

Page 16. "Summary. 1. The lens of animals, in its original state, consists of a peculiar glutinous fluid, which admits of being moulded into various degrees of sphericity, and condensed towards the centre by the functional activity of its capsule. 2. The capsule of the lens is provided around its circumference with a muscular belt, by the constriction of which the two surfaces of the lens are made more convex and the eye adapted to near objects. 3. The radiated zone, (zonula Zinnii,) to which the capsule is firmly attached all round, is provided with a muscular structure, by the contraction of which, and simultaneous relaxation of the muscular belt, the figure of the lens is flattened and the eye adapted to distant objects."

1837. KROHN. UEBER DER STRUCTUR DER IRIS DER VÖGEL, &c. MÜLL. ARCHIV., 1837, S. 556 UND F.

K.'s paper contains an account of Crampton's muscle. The author refers to the notice of Crampton's paper in Gilbert's

Annal., and to treatises by Carus, Maunoir, and Treviranus on the muscles to be found in the iris and the ciliary region. In the account of the ciliary muscular apparatus he says:—

“The lower wall of Fontana’s canal is formed of the vascular coat, (uvea,) as far as the ciliary processes project at its inner surface. The upper wall of the same is a thin membrane, which, from the place where the sclerotic and cornea blend, seems to be prolonged as a lamella of the former to the posterior bridge of the bony ring. I must thoroughly oppose the usual view that it is a plate of the choroid. Around the cornea it is thicker than the sclerotic, but it becomes thinner and transparent in its backward course. This lamella and the inner surface of the bony ring opposite it, include a space which contains the fibre-circle. I have particularly examined the latter in large birds of prey, in which on account of its considerable development it is very accessible, but despite of much pains have only attained incomplete results respecting its anatomical relations. In all birds the anterior part of this structure bordering on the cornea is thicker, and the part towards the posterior margin of the bony ring is more feebly developed. In the eye of owls, and particularly also in the fish-eagle, both parts are separated from one another by an apparently free interval. In smaller birds the structure appears as a single uninterrupted mass. Broad fibres, mostly discernible with the naked eye, form its chief constituent. Taking origin from the bony ring they run rectilinearly, parallel with one another. The lower ends of those anterior fibres plainly attach themselves to the front part of the upper wall of Fontana’s canal. The above-mentioned spaces in the course of the fibres in owls and in hawks no longer prove to be such, when pieces of the wall filling this vacuity are seen under the microscope. Straight fibres, but disposed only in single series, are perceived, which appear to constitute the connection between both portions. The microscopical result is important, that the appearance of these fibres has the most complete resemblance to that of the iris fibres. Although always broader than the latter, they are similarly cross-striped.”

1839. HUECK. DIE BEWEGUNG DER KRYSTALLINSE. DORPAT, 1839.

H. finds adjustment in an action of the ciliary body on the lens.

Page 104. “From the consideration of the position of the ciliary body, the possibility of a contraction of this organ resulted; the examination of its intimate structure renders such an activity also probable.”

Page 108. “With this we should have to regard as almost perfectly certain, as the basis of the inner changes of the human

eye in near vision, as well the advance of the lens, as also the increased convexity of the lens, whilst in distant vision the lens recedes and flattens."

1842. PAPPENHEIM. DIE SPECIELLE GEWEBELEHRE DES AUGES. 1842.

The author discusses at great length several hypotheses, and concludes that the iris is the principal factor of adjustment.

S. 185 und f. "If from what has been said, the share of the ciliary body cannot indeed be certainly rejected, yet it is, to all appearance, only subordinate; and since against the action of the iris on the pupil and the cornea, nothing can be objected, since also all the facts may be explained by this, (which in no other way is possible), since from the iris also the influence of the ciliary body on the lens may be regulated, so, in the present state of knowledge, this may be taken as ascertained, that this action it is whereby the hitherto problematic mechanism is effected."

1845. FORBES, JAMES D. ON A POSSIBLE EXPLANATION OF THE ADAPTATION OF THE EYE TO DISTINCT VISION AT DIFFERENT DISTANCES. TRANS. ROY. SOC. EDIN. 1845.

F. supposes that Accommodation consists in an assimilation of the shape of the softer cortex of the lens to that of the firmer nucleus effected by hydrostatic pressure, which is produced by the compression of the eyeball by the m. recti acting in unison.

The crystalline lens has "a complex and singular figure, which it is plain might produce the same effect (*the correction of spherical aberration*) by the modified curvature of its surfaces. Here, then, we appear to have two peculiarities of structure to attain one end; and it seems so natural that the curves should be proper curves for destroying the aberration of sphericity, instead of the spherical curves which are used in our instruments only, from our incapacity to use better ones, that it occurred to me that the remarkable variations of density in the lens must be intended to answer another purpose."

"This purpose I conceived might be focal adjustment, and effected in the following way: the crystalline lens, for example that of the ox, is composed of a nearly spherical nucleus, of compact comparatively dense matter, of a hard pasty consistence, which gradually yet rapidly passes into the glutinous envelope of a lenticular form which has far less consistence, and far less resistance to external pressure than the central spheroid. It occurred to me therefore that any uniform pressure applied to the lens, such as might be communicated by the external muscles of the eye to the entire eyeball, and propagated by hydrostatic pressure through the humours, would tend to make this exceedingly flattened ellipsoid approach in figure to the dense

spheroidal nucleus, the obvious effect of which would be, without any change in the position of the lens, to increase its curvature, so as to render the rays from a near object more convergent."

"The sensible muscular effort which attends the attempt to view near objects is the retraction of the globe within its socket by the simultaneous action of the four *musculi recti*, which compressing the globe against the structures at the apex of the orbit, increases hydrostatic pressure of fluid humours, which will act simultaneously upon all points of the crystalline lens."

"The crystalline lens possesses in the common view a two-fold structure to produce a single end. I assume that each structural condition has a separate end; the variable curvature to correct spherical aberration, the variable density to alter the figure of it under pressure."

1846. BRÜCKE, E. MÜLL. ARCHIV., 1846, s. 370 UND F. UEBER DER MUSCULUS CRAMPTONIANUS UND DER SPANNMUSKEL DER CHOROIDEA. (VORGETRAGEN IN DER BERLINER PHYS. GESELLS. DER 29. MAI.)

With the eyes of the uhu (eagle owl) and cassowary as patterns, the author undertakes to prove that Crampton's muscle does not flatten, *i.e.*, lengthen the diameter of the cornea, but that it rather shortens it, and in this way adjusts the eye for near objects. This proof is the demonstration of a mathematical problem.

He continues: "Besides Crampton's muscle and those of the iris, the bird's eye has another, which I term the tensor muscle of the choroid. It arises annularly from the inner surface of the bony ring, and attaches itself, with backward coursing fibres, to the choroid." He finds this muscle also in those amphibia whose eyes have a bony sclerotic circle, thus in *testudinata* and all lizard-like amphibia, including the geckos and chameleons, and it possesses the same relations here as in birds. "Also in crocodiles I have found it. It arises here from the front of the sclerotic, and its branches passing backwards attach themselves to the choroid."

1845. STURM. UEBER DIE THEORIE DES SEHENS. COMPT. REND. T. XX, p. 554-761, AND 1238; ALSO POGGENDORF. ANN., s. 116 UND F.

S. derives the solution of the question of Accommodation from simple geometrical considerations. His idea is that the cornea being an ellipsoid, there will not be one single focus for rays incident in its vertical and in its horizontal meridian, but two foci, one for each meridian, separated by an interval; within, or even slightly outside, the limits of which the section of the cone of refracted rays incident from any external luminous

point on the retina will be so small that it will form a sufficiently clear retinal picture of the point.

"Since the central ray, in which are the focal points  $F$  and  $f$ , (*foci of opposite corneal meridians*,) from whence the luminous rays proceed, is almost vertical to the surface of the retina, it can be seen with sufficient distinctness if the line  $Ff$ , although very short, strikes the retina in a point situated between the two focal points  $Ff$ , or even somewhat beyond  $F$ , or on this side of  $f$ ; for then the slender luminous bundle which the pupil has transmitted will occupy an extremely small space, one which is incomparably smaller than the section of this bundle close behind the crystalline lens. The image of a simple point upon the retina may then, indeed, be more extended in length than in breadth; but since the light is more concentrated in the middle of this image, and its two dimensions, although equal, are of extreme smallness, it is intelligible that by their totality they give a pretty distinct and well-defined image of the object."

1847. BRÜCKE. ANAT. BESCHREIBUNG DES MENSCHLICHEN AUGAPFELS. BERLIN, 1847.

Besides a constrictor and a dilator of the pupil, B. finds within the human eyeball a third muscle, also of unstriped fibre, which he regards as a tensor of the choroid.

"The uvea has three muscles, of which one belongs to the choroid, the two others to the iris, namely: 1. The tensor-muscle of the choroid. 2. The contractor of the pupil. 3. The dilator of the pupil."

"The tensor-muscle of the choroid (*m. tensor-chor.*) is the strongest of all three. . . . Its fibres run from behind forwards, and thus lie one by the other as the outer logs of a charcoal-kiln. It attaches itself to the inner wall of Schlemm's canal. . . . The muscle tightens the choroid together with the retina about the corpus vitreum."

In a note B. refers to his first paper on this muscle published in the "Med. Zeitung der Vereins für Heilk." in Preussen, 1846, s. 130 (8 Juli), and to his paper in "Müller's Archiv.," 1846, s. 370, and in reply to the question why he had not compared it with *m. Cramptonianus* of birds rather than with the muscle he had found in birds, testudinata, crocodiles, and lizards, he says that the *m. Cramptonianus* has not any connection with the choroid, but is only stretched between the inner corneal lamella and the bony ring, and it therefore cannot be identified with the human tensor choroideæ.



1849. STELLWAG VON CARION. BEITRÄGE ZUR LEHRE VON DEM ACCOMMODATIONS VERMÖGEN DES MENSCHLICHEN AUGES. ZTSCHR. DER GESSEL. DER ÄRZTE ZU WIEN, VOL. VI, 1849-50.

S. thinks that the lens is pushed forward in its capsule and laterally compressed.

Page 96. "After all that has been mentioned, I think it consequent to derive Accommodation from the pressure which the longitudinal fibres of the iris prolonged into the tensor choroideæ are in a position to exert on the ciliary processes situated in their concavity, as the result of which a thrusting forward of the lens and its lateral compression in its capsule is to be regarded."

1849. BOWMAN, WM. LECTURES ON THE PARTS CONCERNED IN THE OPERATIONS ON THE EYE, &C. DELIVERED AT THE ROYAL LONDON OPHTHALMIC HOSPITAL, JUNE, 1847. LONDON, 1849.

Contains an excellent account of the anatomical relations of the human ciliary muscle. The author thinks that Accommodation for near objects may be explained by an advance of the lens effected by this muscle.

Page 21. "The greater portion, however, of the fibrous continuation of the posterior elastic lamina (*of the cornea*) goes not to the iris, but to the ciliary circle—a name by which anatomists refer to a flattish circle of grey semi-transparent tissue, which intervenes between the ciliary processes of the choroid and the sclerotica, immediately behind its junction with the cornea, about which extraordinary differences of opinion prevail, but which I shall hope to show you, in a subsequent lecture, is muscular. For convenience, therefore, I will now assume that it is such, and term it the ciliary muscle. This muscle arises, then, from the fibrous tissue coming from the posterior elastic lamina—a fibrous tissue passing in a sheet backwards to the anterior region of the ciliary processes, giving origin on its outer surface, or that turned from the anterior chamber, to the fibres of the ciliary muscle, which then clothe the outer surface of the choroid for about one-eighth or one-tenth of an inch, as far as opposite to the ora serrata."

Page 51. "The ciliary muscle forms a greyish semi-transparent band, about one-eighth of an inch broad, on the outer surface of the choroid, between the choroid and the sclerotica; for I do not admit, with some anatomists, that the choroid encloses this structure by splitting in front into two laminæ. It is thickest in front, at its anterior edge, and becomes gradually thinner backwards, terminating about on a line with the ora serrata before mentioned, and corresponding, therefore, on the inner surface to that striated and plicated part of the choroid in front of the retina where the choroid takes hold of the vitreous

body. The outer surface of this muscle when exposed by removal of the outer case, gets soft and almost gelatinous, and it is not easy to distinguish in it anything like fibrous texture. This is partly because it is really less firm than many other muscular parts and its fibres less separated into bundles, but partly, also, because its fibres are arranged rather in layers, of which the outer and larger, which goes from the origin of the muscle to its posterior edge, covers and conceals all the rest. But if a piece be a little raised by the knife, and then torn up by the forceps, the texture is found to give way in lines diverging from the border of the cornea more readily than in any other direction; and further, if a successful vertical section of it be made in a backward direction from the cornea, it will be seen to present more or less evidently the superposed layers as they are represented in the diagram."

The author proceeds to compare this tissue with the best examples of unstriped muscle, and to show their essential identity. Referring to Crampton's muscle in the bird's eye, this and the human ciliary muscle are regarded as analogous.

Page 54. "With regard to the use of the ciliary muscle, this is not the place to descant: but it appears to be so placed as to be likely to advance the lens, by drawing the ciliary processes towards the line of junction of the sclerotica and cornea, and also, perhaps, at the same time by exerting compression on the sides of the ciliary body. Such a movement of the lens would tend to adjust the optical mechanism of the eye to vision of near objects."

1850. WALLACE. THE ACCOMMODATION OF THE EYE TO DISTANCES. NEW YORK, 1850.

The substance of this paper had been previously published in "Silliman's Journal," 1835; "London Medical Gazette," 1842; "Boston Medical and Surgical Journal," 1844. The author discusses several theories involving alteration of the shape of the eyeball, variations of the diameter of the pupil, muscularity of the lens and alteration of its position; and he rejects them all in favour of traction on the back of the lens by the *Campanula Halleri*, which he finds to be muscular, and to have a peculiar pulley-arrangement. He also thinks the marsupium is contractile, and that it is an auxiliary.

Page 9. "Adjustment of spherical lenses. The spherical lens is suspended by a ligament which is formed by the membranes of the vitreous humour, and is sometimes covered with pigmentum nigrum. Beneath the crystalline there is a muscle, (*Campanula Halleri*.) which though it varies in shape and size, is very conspicuous in the halibut, the dolphin, and the striped bass. In the halibut (*hippoglossus vulgaris*) the muscle is

hatchet-shaped, and proceeds diagonally from the lower pole of the crystalline body to be attached slightly to the uvea, but firmly to the anterior and lateral portions of the vitreous humour. In the dolphin, where the attachments are firmest, and in the striped bass (*labrorx lineatus*) the muscle is triangular, and passes through a loop at the back of the iris before being inserted in the membranes of the vitreous humour. When the muscle, which is supplied by a large branch of the third pair of nerves, contracts, the crystalline approaches the cornea, and when it is relaxed, the crystalline is drawn back by the elasticity of the membranes of the vitreous humour, some of which passing through the retina, at a line that in animals furnished with spherical lenses divides the lower portion of this tunic, are firmly fixed to the choroid. The *Campanula Halleri* has by some been described as the ganglion of the crystalline; by others as a cartilaginous body; but, so far as I can ascertain, its muscular character, its passage through the loop at the back of the iris, and its use, were unknown until 1834, when I pointed them out."

Page 16. "... but in birds they (*the ciliary processes*) are muscular."

In the ciliary body W. distinguishes: 1. The annulus albidus, joined anteriorly by fibrous tissue to the sclerotic, muscular fibres radiate from its outer surface. 2. The outer lamina of the choroid which passes to 1, and which consists of the "inner ciliary muscle," and of a cellular ring. 3. The inner lamina comprising the ciliary processes.

Page 21. The marsupium is described as an extraordinary auxiliary factor of Accommodation.

"By means of this retracting membrane these animals are furnished with the extraordinary power of distant vision which their necessities require."

W. gives to the several parts of the adaptive apparatus the following functions: "1. The ciliary ligament attaches the ciliary body to the sclerotic. 2. The outer ciliary muscle constricts the blood-vessels returning from the ciliary processes. 3. Those last, attached by the filaments of Ammon to the ciliary zone and crystalline capsule, become erect and draw forward the crystalline. 4. The inner ciliary muscle, aided by the elasticity of the membranes of the vitreous humours, draw it backwards."

Further, W. describes the adjustment of the retina. This is effected by the choroid gland, which when erected presses the fat or gelatinous fluid which lies between the choroid and sclerotic against the choroid, and in this way causes the retina to advance."

1853. LISTING. ZUR DIOPTRIK DES AUGES. WAGNER'S HAND-  
WÖRTERBUCH DER PHYSIOLOGIE. ED. IV, S. 501. 1853.

L. in this article supposes Accommodation to be effected by an advance of the lens, a recession of the retina, and the diminution of the pupil. The two first are brought about by lengthening of the axis of the corpus vitreum, which is produced by constriction of the equatorial circumference of the eyeball by the contraction of the external muscles.

Page 501. "Without entering more fully upon the question of the faculty of accommodation, not at this time ripe for discussion, and which would be foreign to the scope of this investigation, but which shall be done on another occasion, such remarks may find a place here, cursorily in the form of an hypothesis regarding the nature and dimensions of the adaptive elements, which in the present state of our experimental knowledge bearing on the subject appears most closely to approach the truth, and for which the following considerations might be useful. The process of the adaptation for nearer objects depends on three changes in the eye, which are: 1. The receding of the retina. 2. The advance of the lens. 3. The diminution of the pupil. The two first principal changes may be included under the act of the alteration of the axis of the vitreous humour. This elongation is produced by a compression exerted on the equatorial circumference of the eyeball, effected by means of the simultaneous contraction of both the oblique muscles conjointly with the two straight muscles, the *musc. rect. int.* and *rect. ext.* The two named pairs of muscles, which with reference to the revolution of the eyeball about its mechanical centre act antagonistically, co-operate, without prejudice to this movement of the ocular axis, for the purpose of accommodation in their action, so that the equatorial circumference becomes diminished. This compression causes a change of figure of the imperfectly fluid, and in a certain degree firm, vitreous body, in such a manner that the meridional section assumes another shape, in which the posterior part of the retinal curve, in an extent of about  $30^\circ$  to each side of the axis, is forced outwards or backwards, and the part of the curve corresponding to the hyaloid fossa is moved forwards. By the posterior change of shape, the recession of the central part of the retina is effected, by the anterior the advance of the lens is occasioned. The flattening, or alteration of figure of the cornea, which would be caused by pressure communicated to the aqueous humour by the lens pressed forwards, is compensated by the co-operating tension of the tensor muscle of the choroid. An actual forward movement of the lens is rendered possible by the peculiar disposition of the zonula Zinnii."

1853. DONDERS. NEDERLAND. LANCET, 1853, s. 256 UND f.

This paper contains an account of the anatomy of the muscular apparatus in the ciliary region in birds; D. finds here one muscle only.

"It quickly became evident to me (I had so far only eyes of turkeys, fowls, geese, ducks, and pigeons at my disposal) that one muscle only exists, which should be called the *Cramptonianus*. It arises as an elegant semi-pinnate muscle from the outer wall of Schlemm's canal, in which wall the membrane of Decemet has scarcely any share, and further from the outer side of a fibrous band which separates itself from the wall just mentioned, in order to prolong itself some distance backwards, following the curvature of the bony ring. The foremost fibres run outwards and backwards, and implant themselves in the fibrous tissue of the sclerotic, which clothes the osseous ring internally. In proportion as they arise more posteriorly from the fibrous cord, they take a more backward direction, so that the hindmost following the curve of the sclerotic insert themselves into the outer surface of the choroid, at a level with respect to the bony ring, before the occurrence of the passage of the layer of true cartilage described as bony, into the cornea."

FICK. UEBER DIE ADAPTION DES AUGES. VON D. LUDWIG FICK. MIT EINER NACHSCHRIFT VON ADOLFE FICK. MÜLLER'S ARCHIV. 1853, s. 449.

F. supposes the uvea to be the organ of Accommodation, which it effects by accumulating blood now before, now behind the lens.

"I hold the uvea for the apparatus which (besides the adaptation for admitting adequate quantities of light to the retina, effected by the contraction of the pupil) also brings about the adaption for near and distant vision by means of movements of the lens and by change of its form, which are effected by the transference of varying quantities of blood now before and now behind the lens."

1855. CRAMER. PHYSIOL. ABHANDL. UEBER DAS ACCOMMODATIONS VERMÖGEN DER AUGEN, UNTER REDACTION DES AUTOR'S VERMEHRT UND AUS DEM HOLLÄNDISCHE UEBERSETZT VON DR. DODEN. LAND-PHYSICUS ZU LEER. EINGEFÜHRT DURCH STELLWAG VON CARION. LEER, 1835.

The author discusses at length various theories, and finds the cause of the increased curvature of the front surface of the lens in the influence of contractile structures inside the eye. Neither the crystalline lens nor its capsule possesses contractility, and the zonula Zinnii is also non-contractile.



"The increased curvature of the front surface of the lens is effected by means of the iris. The iris is present in all animals possessing an accommodative faculty, and in many experiments with electricity on eyes immediately after careful removal of the iris no changes in the dimensions of the reflected images of the lens were perceptible. After removal of the cornea, together with the iris detached from the ciliary circle, no change of refraction was noticeable during the passage of the electrical current, but some stretching of the ciliary process was observable, which C. referred to the ciliary muscle. The power with which the iris acts on the parts situated in its concavity is dependent—*a*, on the length of the arc which the iris forms according to its breadth, consequently on the greater or less width of the pupil; *b*, on the degree of tonicity or the contraction in which the longitudinal and circular fibres find themselves."

1867. HELMHOLTZ. HANDBUCH DER PHYSIOLOGISCHEN OPTIK.  
LEIPZIG, 1867.

Page 104. The anterior surface of the lens becomes more curved in viewing near things, flatter in viewing remote things.

This is proved by the variation as regards the size and situation of the reflexion images of a luminous point thrown by the cornea and the front and back of the lens, a method adopted by Cramer and improved by the author.

H. thinks "that the lens, in a quiescent state adapted for viewing distant objects, is extended by the zonula attached to its margin. When the ciliary muscle contracts, it may bring the posterior end of the zonula towards the lens and lessen the tension of the zonula. The tightened zonula must shorten the axial diameter of the lens and lengthen the equatorial diameter, flattening the surfaces of the lens. When the pull of the zonula in accommodation for short distances relaxes, the equatorial surface of the lens becomes smaller, its middle grows thicker, and both surfaces will become more curved. If to this the pressure of the iris now be added, this will arch the equatorial plane of the lens forwards, by which the curvature of the anterior surface will be strengthened, and that of the posterior surface lessened, so that it may again nearly equal the original curvature of the far-seeing lens."

1868. HENSEN UND VOELCKERS. EXPERIMENTAL UNTERSUCHUNG  
UEBER DEN MECHANISMUS DER ACCOMMODATION, VON H. UND V.  
PROF. DER PHYS. UND PROF. D. OPTH. AN DER UNIVERSITÄT KIEL,  
1868.

A series of highly important experiments, conducted with very great care, are detailed by the authors, whose object was to ascertain the exact nature of the share the ciliary muscle has in adjustment.

The orbit was opened, the ciliary ganglion laid bare, and irritated, mechanically and by galvanism. In some of the experiments also the ciliary muscle was exposed.

Page 16. "When the ciliary nerves were irritated the pupil contracted quickly to the diameter of a pin's-head, but not to its complete closure. During this the so frequently-described change of position of the surface of the iris, namely, its recession at the periphery with simultaneous forward arching of the pupillary border, was admirably demonstrated."

The authors had expected that by stimulating a single ciliary nerve apart from the others, they might separate the action of the iris and of the ciliary muscle, but they found this not the case. Every ciliary nerve influenced the iris. The pupil contracted irregularly, and became oval and angular as one, two, or three branches of nerve were excited. That part of the iris supplied by the stimulated nerve acted briskly and the remainder of the iris tardily. After removal of the ciliary ganglion, atrophine acted with unabated strength. The oozing of a little clear fluid from beneath the free border of the pupil when this was lifted off the front of the lens, by seizing the iris over the ciliary processes with a fine forceps, showed the existence of a posterior chamber. When the ciliary nerves were stimulated, the ciliary muscle, seen through an opening in the sclerotic, was noticed to swell. When the cornea was cut away 2 mm. from its circumference, leaving only a small rim of it attached to the muscle by the ligament. pectinatum, the muscle, in contracting, drew this ring of cornea strongly inwards towards it.

Page 25. "We found an evident forward displacement of the choroid." P. 26. "We saw this displacement now with ease and constantly, namely, when into the uninjured globe a fine needle is thrust through the sclerotic into the choroid, the free end of this moves with every accommodation vigorously backwards; consequently, since the point of perforation in the sclerotic remains unvaried, the point of the needle must be drawn forwards by the choroid."

When two needles were inserted, the first separated from the second during accommodation, and returned towards it when accommodation rested, excitation of single ciliary nerves excited contraction of corresponding segments of the ciliary muscle.

"The displacement of the choroid amounts at the equator to  $\frac{1}{2}$  mm.; further towards the optic nerve its extent decreases." The retina follows these movements of the choroid.

The experimentors found that both surfaces of the lens become more convex, the anterior most.

From the movement of a needle pushed through the sclerotic into the corpus vitreum, and made to touch the back of the lens, they say "it may be recognised that its curvature increases and that its posterior surface recedes somewhat into the vitreous body."

As regards variations in the *ciliary processes*, their observations were only partially successful, but they say:—"What we saw compelled us to conclude that they are absolutely quiescent, even a needle which was thrust across a series of them remained almost quiet."

When a glass thread was placed in contact with the zonula, through an opening in the sclerotic, it appeared that relaxation of the zonula took place when the ciliary nerves were excited.

The theory of Accommodation, based on these experiments, which they adopt will appear from the subjoined extracts.

"In explaining the accommodative process, we must start from the elasticity of the lens."

This elasticity results from its structure. "Now the tendency of the lens to arch itself is overcome by the tension of the zonula Zinnii, whose points of origin are kept distant from the lens by various forces. 1. By the tension which prevails in the corpus vitreum. This keeps the wall of the globe distant from the lens, it presses the lens forwards, it arches the zonula in its course upon the ciliary body. 2. By the elasticity of the choroid. This drags the posterior insertion towards its punctum fixum, the opticus. 3. By the elasticity of the ligamentum pectinatum, which inserts itself into the base of the iris and draws this as well as the part of the ciliary body connected with it towards the margin of the cornea. By this it produces tension of the anterior fibres of the zonula; besides, in unison with the corpus vitreum, it perhaps determines the forward course of this membrane. These three momenta in unison condition a flattening of the capsule, which the extension of the lens fibres hinders."

"The outcome of our investigation was that the muscle draws the choroid towards it, and also stretches the ligamentum pectinatum, into which a part at least of its fibres enters. By the advance of the choroid and retina the origin of the zonula Zinnii is also brought somewhat closer to the lens, and simultaneously the corpus vitreum is subjected to a higher pressure. Further, if the iris until now was drawn by the ligamentum pectinatum towards the border of the cornea, this traction becomes weakened by the action of the muscle. Since, now, at the base of the iris fibres of the zonula already arise, the point of origin of the same can with more ease than before be drawn towards the lens."

"In such a manner the elasticity of the lens becomes unfettered, and simultaneously by the recession of the iris the pressure in the anterior chamber becomes lowered."

"Since, now, the tension in the corpus vitreum is heightened, there follows not only an arching of the lens, but at the same time it moves slightly forwards, and so it fills indirectly the

space which is left between the fibres of the ligamentum pectinatum."

1862. LEE, J. R., M.B., CANTAB. OBSERVATIONS ON THE CILIARY MUSCLE IN FISH, BIRDS, AND QUADRUPEDS. JRNL. OF ANAT. AND PHYS. VOL. III, P. 14. CAMBRIDGE AND LONDON.

This paper is illustrated with nine woodcuts.

The author recommends the following method as the most suitable for demonstrating this organ.

"The eye should be placed in water as soon after the animal is killed as possible, and exposed to the influence of a gentle flow from a tap, in order to wash away all trace of blood from the tissues. After being treated for three days in this way, it should be immersed in pure alcohol, or methylic alcohol, in which it may remain for any length of time until the dissection is commenced."

The dissection is to be made under water or alcohol, with the aid of scissors and needles and a powerful magnifying glass.

Dr. L. finds that, "In all the species of fish common in this country there is no vestige of any structure corresponding to it" (the ciliary muscle). Where the iris does not move the ciliary muscle does not exist; the activity of the iris was observed by the author to be directly proportional to the degree of development of the ciliary muscle." P. 16.

In the cat the ciliary muscle is remarkable for its great size. It arises from the anterior border of the sclerotic close to the margin of the cornea, and it passes backwards to the choroid, forming so intimate a connection with it as to appear really part of that membrane.

The author adds: "I have reasons for believing that its chief function in this class of animals is to increase or diminish, in a remarkable manner, the flow of blood to the erectile tissue of the iris, on which the size of the pupil depends."

In figs. 3, 4, and 5, illustrating the relations of the ciliary muscle, under which term the author comprises both Crampton's and Brücke's muscle, in the common fowl, all its bundles are represented as passing between the sclerotic and choroid. As regards the method of Accommodation, the author says:

"The result of numerous dissections which I have made leads me to consider, that the various theories which have been advanced at different times to explain the means by which the eye is enabled to adjust itself for distance are inconsistent with the anatomy of the organ of vision, and I trust that it will not be thought presumptuous to express my belief that this phenomenon will be found explicable by the simple law of optical science which requires nothing more than a change in the relative position of the lens and the retina to accommodate the eye to near and distant objects."



1872-3. LEE, R. J., M.B., M.D. REMARKS ON THE SENSE OF SIGHT IN BIRDS, ACCOMPANIED BY A DESCRIPTION OF THE EYE, PARTICULARLY OF THE CILIARY MUSCLE, IN THREE SPECIES OF THE ORDER RAPACES. PROC. ROY. SOC., VOL. XX, NO. 135, P. 351.

The author proposes to describe certain peculiarities in the bird's eye, and "to examine to what extent these enable us to explain the remarkable powers of sight with which all species of birds are more or less highly endowed."

"It is to one particular property of the eye that my own observations have been chiefly directed, namely, the power of Accommodation for distance, and I shall endeavour to show that in birds great range of vision depends upon the development and character of the ciliary muscle." P. 352. In other words, the faculty of visual perception of objects at very considerable distances is made dependent on a commensurate development of the ciliary muscle, under which term, as also in an earlier paper, the author includes, without distinction, all the muscular structures in the ciliary region. Subsequently this opinion is modified by the statement (generally accepted) that the chief function of the ciliary muscle is to adjust the sight for near objects. The eye of the eagle-owl, Egyptian vulture, and buzzard are next described. Under the name of "anterior elastic filaments," the author describes the "system of fine elastic fibres, which pass from the corneal margin of the sclerotic to the line of union between the iris and the choroid," commonly known as the "*ligamentum pectinatum iridis*," and by Bowman termed the "*pillars of the iris*." Between this and the *posterior elastic ligament*, (already mentioned by H. Müller and others,) is interposed the "ciliary muscle, the body of which is attached to the line of union of the sclerotic and cornea, so that it may be said to arise from the anterior angle of curvature (of the globe). The greater part of the posterior portion of the muscle is of a delicate tendinous structure; its line of insertion into the choroid is the same as, but on the opposite side of, the line of insertion of the posterior elastic ligament." P. 355.

The author thinks it reasonable to suppose that "contraction of the ciliary muscle would produce a change in the position of the lens,"—"the muscle is employed in Accommodation for short range of vision." "The position of rest is restored by the posterior elastic ligament which acts in opposition to the muscle."

From measurements of the diameter of the eyeball and of the lens, of the length of ciliary muscle and its associated elastic ligaments, the author concludes that in the eagle owl the range of vision is small, the power of accommodation very rapid; in the vulture the range of vision is great, the power of accommodation considerable, but slower than in the owl; in the buzzard the range



of vision is greater still, and the power of accommodation capable of being readily and extensively exercised.

SUPPLEMENT, CONTAINING A DESCRIPTION OF THE EYE IN RHEA AMERICANA, PHENICOPTERUS ANTIQUORUM, ET APTENODYTES HUMBOLDTII.  
RECEIVED AP. 27, 1872. IB., P. 358.

The author finds Crampton's account of the ciliary muscle correct as far as it goes, but that the tendon and its insertions into the choroid were unknown to him. Measurements of the globe and lens and ciliary apparatus are given in a tabular form.

## PART II.

### CONTEMPORARY OPHTHALMIC LITERATURE.

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#### LUPUS OF THE CONJUNCTIVA.

DR. ALEXANDER records a case of lupus of the conjunctiva of the lower lid in a man, æt. 27, of eighteen months' duration. Treatment was of no avail.—("Zehend. Klin. Monat.," xiii, Sept., p. 329.)

#### TUBERCULOSIS OF THE CONJUNCTIVA.

DR. J. HOCK records two cases. One patient was a boy, two years of age. Six months before he had had a patch of congestion on the conjunctiva at the outer angle of the right eye, and after this had disappeared a small tubercle remained which gradually increased in size; when seen there was a lentil-sized ulceration of the conjunctiva, on a tumour the size of a hazel nut, and situated rather above the horizontal line at the outer angle. Microscopic examination of tissue from the growth showed lymph and epithelioid cells. Three months later the tumour had penetrated to the interior of the eye; the patient died of tubercular meningitis. The second patient was 62 years of age, and the subject of phthisis. There was an ulcer on the inner surface of the right upper lid at the outer part. Treatment by means of cauterisation was being attended with success, but the patient died of pulmonary phthisis.—("Zehend. Klin. Monat.," xiii, Sept., p. 309.)

#### TUBERCULOSIS OF THE CONJUNCTIVA.

DR. WALB records a case. The patient was a lad. There was a growth on the upper part of the ocular conjunctiva of the right eye. He was not seen again for some weeks, and then there was well marked suppuration of the uveal tract; a portion of the tumour which had been snipped off was examined, and found to have the histological structure of tubercle here and there, the remaining parts consisting of epithelial cells. Two illustrations are given. The author does not think the disease ought to be called lupus, because of the thickness and uniformity of the tumour, and the complete absence of any tendency to produce a cicatrix. The patient was strumous, or phthisical, and the relatives phthisical.—("Zehend. Klin. Monat.," xiii, Juli., p. 257.)

## TRANSPLANTATION OF CONJUNCTIVA FROM THE RABBIT.

DR. SCHMIDT RIMPLER records a successful case in a lad of 15, for symblepharon.—(“Zehend. Klin. Monat.,” xiii, Sept., p. 312.)

## CYSTICERCUS CELLULOSE SUB-CONJUNCTIVALIS.

DR. TALKO records a case and quotes the literature of the subject.—(“Zehend. Klin. Monat.,” xiii, Aug., p. 299.)

## BLEPHAROSPASM, SECTION OF SUPRA-ORBITAL NERVE.

DR. GEO. STRAWBRIDGE records the case of a gentleman, æt. 44, who had for long been troubled with blepharospasm. Pressure on the corresponding supra-orbital nerve checked the spasm. After division of the nerve, relief followed for a time only. Then the patient found out accidentally that biting any hard substance with the incisor teeth at once checked the spasm. This only lasted a few days however. In another case, that of a man, æt. 27, the supra-orbital nerve was divided for neuralgia; in this respect it was successful, but in twenty-four hours the patient complained of a great want of taste. This condition lasted four days, after which the sense of taste was gradually restored.—(“Arch. of Ophth. and Otol.,” vol. iv, Nos. 3 and 4, p. 403.)

## BLEPHAROSPASM OF A YEAR'S DURATION, TEMPORARILY RELIEVED BY THE EXTERNAL APPLICATION OF TINCTURE OF IODINE.

PROF. W. ZEHENDER relates the case of a young girl who suddenly became affected with severe blepharospasm. Attempts were made by pressing on various parts to relieve the spasm, but it was found that, on the contrary, pressure on certain parts (over the infra-orbital and supra-orbital foramina, and over the space between the occiput and the atlas, and over the spinous process of the first dorsal) increased the spasm. Pressure also on some other parts had the same effect. At the end of five months a ring of vesicles (herpes corneæ) appeared first in one cornea and then on the other for a period of six or eight weeks. At the end of about six months from the commencement of the affection, tincture of iodine was painted over the region of the atlas. The effect was remarkable. In about seven hours the spasm ceased completely, and did not return for nineteen hours. The painting was repeated on the third day with a similar result, but the skin became so sensitive and sore, that further applications could only be made at long intervals. Other parts were painted with similar results. After a time this great sensibility subsided, and the neck could be painted every three or four days. Once there was an intermission of four days. After the first few applications the effect

was instantaneous. After four months a complete change occurred, the spasm being replaced by ptosis, due to tonic spasm of the orbicularis. No remedies whatever now availed. Pressure however on one spot on the forehead caused the eyelids to open. An instrument was fitted, and pressure could be borne for a time, during which the eyes could be opened. At last hopes were entertained of recovery by residence at a watering place.—(*"Zehend. Klin. Monat.,"* xiii, Aug., p. 293.)

#### OPERATIONS FOR THE RELIEF OF CHRONIC BLEPHARITIS.

DR. ADOLPHE WEBER, starting from the supposition that many cases of blepharitis depend on some obstruction to the free escape of the tears, other than disease of the lachrymal sac or duct, proposes certain operations for (1) cases in which from cicatricial contraction of the edges of the eyelids, &c., the eyelid is stretched between the internal and external palpebral ligaments, and the usual movement of the lid downwards and inwards cannot be executed, and hence the propulsion of the tears towards the sac is interfered with, and the puncta are displaced so that the tears cannot enter them. In a (2) class the eyelids are relaxed, the follicles inflamed, and some transparent mucous discharge may be squeezed from the sac without, however, there being any impediment to the passage of probes. In a (3) class there is an exaggeration of the one just mentioned. The external commissure may be sunk down lower than normal. In the (1) class if the border of the eyelid alone be affected, and there be no tendency to ectropion, a vertical oval portion of skin and muscle may be removed from between the external commissure and the insertion of the external palpebral ligament at the margin of the orbit. The insertion of the ligament is then sought for and divided. The eyelid yields at once. Should it not do so sufficiently, the tarso-orbital aponeurosis must be notched. When there is ectropion, the portion of skin removed must be close to the external commissure, and the muscle must be left intact, and before cutting the ligament the skin must be separated by passing a knife between the two, as the skin is generally adherent in such cases. In the (2) class if the margin only is relaxed, a semi-lunar portion of skin is removed close to the commissure; if the whole lid is affected, four incisions are made, and a V shaped portion of skin is removed with the base outwards. The edges are brought together with sutures. In the (3) class a rectangle is excised involving skin, muscle, and aponeurosis, the ligament remaining intact—(*"Annales d'Oculistique,"* Nov., Dec., 1875, p. 249.)

## CANTHOPLASTY.

DR. AGNEW recommends incision at the outer canthus in cases of photophobia and blepharospasm complicating phlyctenular ophthalmia, &c. The patient is anæsthetised, the external commissure put on the stretch by the thumb and index finger, and then slit up to the bottom of the conjunctival cul-de-sac. Scissors answer well for the purpose. The length of the incision varies from 12 to 15 mm. (.48 to .6 inch.) No bleeding is ever caused sufficient to require a ligature. The surgeon then takes hold of the upper eyelid between the thumb and index finger, and draws it slightly upwards and towards the nose until he feels that the external ligament is well on the stretch. This accomplished, he introduces the points of a pair of scissors into the wound, and notches the margin of the said ligament near the margin of the orbit. The cut should be perpendicular to the transverse wound just made, and one blade of the scissors should pass between the skin and the ligament, and the other between the ligament and the conjunctiva. The ligament will be felt to give way distinctly. The tarsal ligament of the lower eyelid should be left intact. Lastly, the edges of the skin and conjunctiva should be united together. The sutures may be removed in forty-eight hours. The formation of crusts should be avoided by appropriate treatment. This plan of incising the external commissure prevents injurious pressure on the globe, and in many cases there has not been any return of the (phlyctenular) ophthalmia. He has practised the operation in 191 cases.—(*Annales d'Oculistique*," Sept., Oct., 1875, p. 180.)

## FOUR CASES OF PANNUS TREATED BY INOCULATION SUCCESSFULLY.

DR. BRIÈRE records the cases.—(*Annales d'Oculistique*," Juillet, Août, 1875, p. 76.)

## OPHTHALMIA NEONATORUM.

DR. S. C. AYRES reprints a pamphlet on this subject, entitled "A Comparison between the results of the Treatment in one hundred cases in Private and one hundred cases in Hospital Practice." He thinks there are undoubtedly many cases where there is no abnormal vaginal discharge to account for the appearance of the disease in the child even in a severe form. He has found the disease thoroughly amenable to treatment by cleanliness and use of weak astringent lotions when employed early. The cases in which loss of vision has occurred have been those in which the cornea was affected before the child came under care. In all the cases (100) treated in the hospital, from the first, no corneal complication arose. He seems to imply that in



this large number of cases they looked in vain for an explanation of the origin of the disease. The 100 cases represent the total number of children affected among 726 born during the same period, and attended under similar circumstances.

## TWO PUNCTA ON ONE LOWER EYELID.

DR. F. RAAB records a case.—(*"Zehend. Klin. Monat.,"* xiii, Sept., p. 331.)

## FISTULA LACHRYMALIS VERA CONGENITA.

DR. STEINHEIM records a case in a girl of 14. The fistulous opening was situated at the outer third of the upper lid, a third of an inch from the ciliary margin, and surrounded by a tuft of hairs. It was difficult to follow the tract of the fistula.—(*"Zehend. Klin. Monat.,"* xiii, Aug., p. 302.)

## THE ANATOMY OF THE LACHRYMAL CANALS.

DR. HEINRICH HEINLEIN gives an account of the naked-eye anatomy of the canaliculi, as shown by sections made in young children. Illustrations accompany the paper. Each canaliculus shows an enlargement below the punctum where the vertical passes into the horizontal portion, and just beyond this there is a diverticulum. Muscular fibres having a course almost parallel to the canaliculus are in relation with it.—(*"Graefe's Archiv."* Bd. xxi, Abth. iii, p. 1.)

AN ORDINARY STRABISMUS OPERATION FOLLOWED BY TENDITIS—  
PERFORATION OF THE SCLEROTIC—DETACHMENT OF THE RETINA  
—RECOVERY.

DR. POOLEY operated in the ordinary way on a young woman for internal strabismus. He ascertained afterwards that she was under treatment for intermittent fever at the time. The next day there were signs of commencing inflammation, and in a few days there was exophthalmos, chemosis, and swelling of lids. An abscess seemed to have formed, and an incision was made through the conjunctiva over the situation of the muscle. This was followed by the escape of a drop of pus, and then of perfectly healthy vitreous. The wound in the sclerotic subsequently gaped at each examination, and vitreous several times escaped. At the end of a month the external wound had closed, but a detachment of the retina was found. She finally recovered with very fair vision, and there was no detachment of the retina remaining, but opposite the seat of injury there was a distinct white patch in the choroid.—(*"Archives of Ophth. and Otol.,"* vol. iv, Nos 3 and 4, p. 410.)

ON STRABOMETRY.

DR. E. LANDOLT advocates angular measurement of strabismus in preference to the linear method usually practised. He measures the amount of strabismus on an arc, the patient's head being fixed and the eyes directed to an object in front. A line drawn from the object through the zero of the semicircle is made to represent the direction the eye ought to take, and then the real position of the eye is estimated by causing the reflexion of a candle moved along the semicircle to fall on the centre of the cornea. When this happens the angle of displacement can be read off at once. The angle may also be measured by the position of the false image seen by the squinting eye. Prisms do not afford so good a test. They underrate the angular displacement.—("Annales d'Oculistique;" Juillet, Août, 1875, p. 61.)

A CASE OF DOWNWARD STRABISMUS FROM CONGENITAL PARALYSIS OF THE SUPERIOR RECTUS; ADVANCEMENT OF THE MUSCLE AND TENOTOMY OF THE INFERIOR RECTUS.

DR. F. C. HOTZ, of Chicago, records the case. The patient was a girl, æt. 8. There was also congenital ptosis, which was operated on at the same time. The result was favourable.—("Archives of Ophth. and Otol.," vol. iv, Nos. 3 and 4, p. 399.)

TWO CASES OF CONGENITAL STAPHYLOMA OF THE CORNEA.

DR. KRÜKOW notes cases under the care of Prof. O. Becker, showing various congenital malformations (staphyloma, microphthalmos, microcornea, opacity of the cornea, and aphakia). He gives a detailed description of two eyes affected with cicatricial corneal staphyloma from intra-uterine changes, and quotes cases at all analogous recorded by Beer, Sonnenmayer, and Crampton. In the first case, the *corneal staphyloma* was associated with a *cyst situated between the iris and the cornea*. There was a distinct cyst-wall which could be peeled off. The cyst was divided by bands into several compartments. Figures are given of the eyeball in section and of the microscopic appearances. One remarkable feature was that the cyst-wall was lined with a layer of *ciliated cylindrical epithelial cells*. The origin of these is discussed. It is scarcely possible they could have originated from structures normally present. There are two ways by which ciliated cells could have reached the iris. Some cells may have become detached from the respiratory passages, floated in the liquor amnii, and passed into the anterior chamber before the palpebral fissure had closed, (at the end of the third or fourth

month,) or they may have come from the lachrymal canal. In the latter case there would be no need to suppose the palpebral fissure open, but the cells would be unlikely to travel upwards to the conjunctival sac. They would almost certainly pass downwards. It is of course possible that inflammation and perforation of the cornea occurred before the closure of the fissure, or the fissure may have opened again earlier than normal. If ulceration of the cornea occurred and increased secretion of tears, the separation of the lids may have been hastened and then perforation of the cornea having occurred, liquor amnii, &c., may have obtained access to the anterior chamber. If the fissure had spontaneously opened earlier than usual, the liquor amnii may have irritated the cornea and set up the further mischief. The child first of all came under Prof. Becker's notice when two months old. The left eye was quite normal. The right in a state of staphyloma. At the age of eighteen months, as the staphyloma was increasing, the eye was removed. There was still perception of light. The author was of opinion there could be no doubt as to the intra-uterine origin of the changes, owing to the mother's positive statement that she noticed the right eye was affected immediately after birth, that the eye projected between the lids, and that since birth the child had had no inflammation of the eyes. The second case was that of a lad, æt. 11. He came of healthy parents of high social standing, and of a family in which intermarriages were common. The parents had normal eyes. There was fifteen years' difference in their ages. The eldest son was hypermetropic in the right eye  $\frac{1}{11}$  with V.  $\frac{2}{40}$ . The cornea was exceedingly small, the anterior chamber diminished in size, and the pupil contracted. The left cornea was opaque, only a small portion in the centre remaining clear and another part upwards and downwards. The pupil was drawn somewhat upwards and inwards, and the iris was adherent to the cornea. The lens (if present) was transparent. The fundus could not be seen. The eye, which was small altogether, was affected with nystagmus. He could just count fingers with it. Four younger children had normal eyes. All the children were well-built and had well formed features. The second son, the patient, æt. 11, had microphthalmos on the left side and nystagmus, and the eye altogether resembled the left eye of the elder brother, but the transparent portions of cornea were differently situated. He could count fingers and recognise large letters. It was impossible to prove whether the lens was present or not. The right eye was enlarged in all its dimensions, and appeared pear-shaped, the broader part being forwards. The staphyloma was rather intercalary than corneal or sclerotic. There was great nystagmus, no perception of light, and considerable increase of tension. After most careful inquiry it seemed certain that the conditions of the four eyes mentioned were present at birth. The medical

attendant, nurse, &c., were positive no inflammation had occurred subsequently. V. Graefe had attempted iridectomy in the case of the younger son when two years old. The staphyloma had greatly increased during the two years before he came under observation. After removal of the eye the most noticeable change was *absence of the lens* and its capsule. The zonule of Zinni remained. The eyeball is shown in section.—(“Graefe’s Archiv. f. Opth.,” Bd. xxi, Abth. 2, p. 213–235.)

## APOPLEXIES OF THE CORNEA.

DR. SCHMIDT REMPLER records a case of prolapse of iris, in which while improvement was apparently steadily progressing, a considerable hæmorrhage into the cornea occurred. The epithelium on its surface remained intact, but the substance of the cornea was evidently much softened, and the external layers easily peeled off.—(“Zehend. Klin. Monat.,” xiii, Sept., p. 317.)

## FIBROMA LIPOMATODES (XANTHELASMA) OF THE CORNEA, WITH MULTIPLE CUTANEOUS TUMOURS OF THE SAME STRUCTURE.

DR. J. HIRSCHBERG records a case in a man, *æt.* 30. The cutaneous growths had been noticed since he was eight years old. The corneal affection was so severe in one eye as to necessitate enucleation of the globe. The patch on the other was small and deeply seated in the substance of the cornea.—(“Archives of Opth. and Otol.,” vol. iv, Nos. 3 and 4, p. 355.)

## POLYOPIA MONOCULARIS IN AN EYE, THE CORNEA OF WHICH SHOWED DIFFERENT RADII OF CURVATURE IN DIFFERENT PARTS.

DR. LEOPOLD WEISS describes a case in which the cornea was flatter in the centre than at the periphery; the opposite to what occurs in kerato-conus. The patient saw three images of an object through some parts of the cornea, and two in others. When three were seen, two were directly under one another, and the third alongside the lower one. The patient was highly hypermetropic. The other eye was astigmatic. Measurements of the curves of the cornea are given.—(“Graefe’s Archiv.,” Bd. xxi, Abth. 11, pp. 187, 204.)

## VASO-MOTOR AFFECTIONS OF THE EYE.

DR. SAMELSOHN contributes the first of a series of papers on this subject, and deals with a vaso-motor neurosis of the ciliary body (cyclitis vaso-motoria). A man, *æt.* 28, came under his

care with ciliary congestion of the right eye. There were no changes in the iris or other structures. The patient had intolerance of light, pain, sense of foreign body in the eye, &c. The pupil was small and would not dilate on the instillation of atropine. After persisting for some time, these symptoms diminished simultaneously with the appearance of an outbreak of herpes zoster on the right side of the scalp. The author discusses the different causes leading to ciliary congestion under (1) impediment to the escape of venous blood, and (2) increased afflux of venous blood. He enters at great length into various vaso-motor disturbances which have been noticed in the eye in connexion with the hemi-crania, herpes, &c. He thinks many of the causes of ciliary congestion are associated with vaso-motor paralysis of the arteries supplying the anterior part of the eye-ball. He mentions the case of a young woman who came under care for great irritation of the eyes and ciliary congestion, and in whom the symptoms abated on the outbreak of herpes on both sides of the face. He himself had an attack of irritation of one eye with ciliary congestion which disappeared on the outbreak of a patch of herpes on the side of the nose. In another patient who suffered from pemphigus, which, at first generally distributed, had latterly been confined to outbreaks on the head and face, associated with irritation of one eye and ciliary congestion, the latter symptoms would disappear with the appearance of blebs. In another case of frontal herpes zoster, a bluish patch appeared at the outer part of the cornea on the same side associated with ciliary congestion. Another patient was affected with irritability of the left eye and left side of the head, associated with congestion of the left half of the face, &c., and sweating on that side after exertion. In this case also an eruption of herpes occurred. The patient also had slight ptosis (*sympathico-paralytica*). The pupil was small and reacted to light, but imperfectly to atropine. The first patient whose case is noted, came under care again with the other eye affected in a similar manner, and again this eye improved after an outbreak of herpes. In a sixth case, an eruption of herpes on the lower eyelid preceded the ocular symptoms, which finally yielded after the occurrence of a more copious outbreak.—(*"Graefe's Archiv.,"* Bd. xxi, Abth. 3, pp. 29, 99).

## CYCLITIS AND SYMPATHETIC OPHTHALMIA.

DRS. REICH AND SAVARY communicate cases with remarks, and Dr. Warlomont also notes a case. They all, except Dr. Reich's case, show the importance of early (preventive) interference, that is, the removal of the injured eye. Removal of the first affected eye when once sympathetic mischief has been excited



may be advisable, but is seldom attended with much benefit. Dr. Reich's case was that of a man, *æt.* 45, who came under care for cyclitis of the right eye, attended by symptoms of spasm of the ciliary muscle (*myopia*). There was no history of injury. About a month from the commencement of the symptoms the left eye became affected. In neither eye was the iris ever much affected, but slight adhesions to the capsule of the lens formed. (This is published as a case of sympathetic affection of the second eye, but the evidence is not conclusive.) Dr. Savary notes numerous cases showing the danger attending constriction of iris in the lips of a wound. In one case he was successful in re-opening the wound and disengaging the iris. In one of his cases, and in Dr. Warlomont's case, a foreign body was present within the eye, when there was not much reason to suspect any such complication. There was an interval of 16 years in one case. Dr. Warlomont appends the suggestions he brought before the Congress held in London. 1. That when an eye which has been lost from any cause whatever (or a stump of a lost eye) is the seat of irritation, continuous or intermittent, or in a state of inflammation, acute or chronic, it may give rise to sympathetic affections of the other eye. This sympathetic mischief may arise even without any signs of irritation in the eye first affected. In either case enucleation of the eye first affected is indicated. 2. It is important to perform the operation as soon as possible after the appearance of the symptoms. When once sympathetic irido-cyclitis with exudation has been set up, enucleation is almost always unavailing, because it has been too long delayed. 3. When an eye has been destroyed by injury it is very important for the patient's sake to remove it at once, before secondary inflammatory changes take place. This is especially important if there be a foreign body within the eye. In conclusion he cites a very striking case. A lad, *æt.* 17, received an injury from a piece of iron which inflicted a wound across the cornea, involving the ciliary region on either side, and resembling in appearance the state of affairs after extraction of cataract by a median incision. The lad was sure the piece of iron had dropped at his feet. He was seen about a month after the accident. There was no sympathetic irritation. Excision was advised but declined. Inflammation in the other eye followed in a few days. Enucleation showed that a piece of iron had penetrated and remained within the eye.—(*"Annales d'Oculistique,"* Jan., Fév., 1876, p. 13, 33.)

#### SYMPATHETIC OPHTHALMIA RELIEVED BY ENUCLEATION.

DR. WEBSTER records the case of a boy, *æt.* 7, under the care of Dr. Agnew. Seven and a half weeks after an injury to one

eye, the other was suddenly noticed to become reddened and moderately sensitive to light. The vision was much impaired, and the media so opaque that the fundus could not be seen. There were several iritic adhesions. The injured globe was removed the same day, and a piece of gun-cap found in it. The remaining eye improved under the use of atropine, &c. At the end of three months complete recovery had apparently occurred.—(*"Archives of Ophth. and Otol.,"* vol. iv, Nos. 3 and 4, p. 389.)

#### FOREIGN BODIES IN THE INTERIOR OF THE EYE.

DR. B. B. SCHWARZBACH records cases under the care of Dr. Hirschberg (at Berlin). In one case a foreign body had passed through cornea, iris, lens and vitreous, and lodged at the back of the eye. The ophthalmoscopic appearances were very interesting. Vision seemed unimpaired. Other cases are narrated of foreign bodies in the lens or behind it or on the iris. In one case a patient came on account of a piece of wood on the cornea, and it was found he had a fragment of iron in the interior of the eye. In another a fragment of iron was found in the iris of the supposed unaffected eye. In a third case a patient applying for traumatic keratitis of one eye was found to have a cysticercus intra-ocularis of the other.—(*"Archives of Ophth. and Otol.,"* vol. iv, Nos. 3 and 4, p. 414.)

#### HERPES ZOSTER OPHTHALMICUS.

Dr. J. COPPEZ contributes a second paper on this subject, the first having appeared in Mai-Juin, 1873. Two cases are mentioned in which the eye became affected with kerato-iritis without any spots being present on the nose, and one in which the cornea inflamed under the same circumstances. The side of the nose was affected in one case with ulceration of the cornea; in another with inflammation of the cornea, iris and choroid, and in a third with hypopyon-keratitis. In one case extensive scars were present without any ocular affection.—(*"Annales d'Oculistique,"* Jan., Fév., 1876, p. 33-50.)

#### WOUND OF THE EYE FOLLOWED BY THE GROWTH OF A TUMOUR IN THE IRIS AND CHOROID.

THE patient was a woman, æt. 51, under the care of Prof. Becker, and the case is recorded by Dr. Raab. The growth in the iris contained a foreign body, and consisted of spindle cells and small round cells with pigment. The choroidal growth was separate from the tumour in the iris, and had all the characters of a sarcoma of the choroid. Full details are given of the

various points in the case. The iris had been drawn back so as to be invisible before removal of the eyeball, and remarks are made as to retraction of the iris in general.—(*"Zehend. Klin. Monat.,"* xiii, Juli., p. 239-256.)

CASE OF MYDRIASIS KEPT UP BY THE INSTILLATION OF ATROPINE  
FOR FOURTEEN MONTHS.

DR. BRIÈRE records the case of a young gentleman, *æt.* 15, who kept one pupil dilated for four months with atropine, and was only detected with difficulty. A cure followed in ten days on leaving off the atropine.—(*"Annales d'Oculistique,"* Juillet, Août, 1875, p. 84.)

EXUDATION RESEMBLING A CRYSTALLINE LENS IN A CASE OF IRITIS  
FOLLOWING WOUND OF THE SCLEROTIC.

DR. SCHMIDT-RIMPLER records a case.—(*"Zehend. Klin. Monat.,"* xiii, Sept., p. 315.)

RUDIMENTARY IRIS.

DR. BURNETT records the case of a negro, *æt.* 30, in whom he found the iris in each eye very imperfectly developed. A figure of one eye is given. There was a small white spot on the front of the capsule of each lens.—(*"Archives of Ophth. and Otol.,"* vol. iv, Nos. 3 and 4, p. 402.)

THE ANATOMICAL CHANGES FOLLOWING IRIDECTOMY.

DR. ADOLPHUS ALT details numerous observations he has made on rabbits, and also gives an account of some specimens from the human subject. The paper is illustrated.—(*"Archives of Ophth. and Otol.,"* vol. iv, Nos. 3 and 4, p. 423-444.)

DOUBLE SIMPLE IRIDECTOMY FOLLOWED BY SLOUGHING OF BOTH  
CORNEÆ.

DR. H. KNAPP records the case of a child a year old on whom he performed iridectomy in each eye downwards and inwards in order to form artificial pupils. There was an irregular, probably congenital, nuclear cataract in each eye. The next day inflammatory symptoms set in, and in spite of treatment both corneæ sloughed, the irides bulged forwards, and both eyes were irrevocably lost. Somewhat similar cases are on record.—(*"Archives of Ophth. and Otol.,"* vol. iv, Nos. 3 and 4, p. 445.)

## EXTRACTION OF CATARACT.

DR. J. HIRSCHBERG gives the results of 100 cataract extractions performed on Graefe's plan. ("Berl. Klin. Wochenschr.," 1876, No. 1 and reprint.) The patients were 74 in number. One eye only being operated on in 48 and both in 26. He does not approve of operating on both eyes at the same time, however. He always leaves a short interval (eight to ten days). 51 operations were performed on males and 49 in women. In 6 cases vitreous was lost; in 4 without ill result, and in 2 with subsequent loss of vision. Primary suppurative iritis (iridophakitis, irido-choroiditis) occurred in 4 cases. There was no case of primary suppuration of the cornea. For secondary cataract, &c., he has almost always performed iridectomy. He obtained useful eyes (V. 1 to  $\frac{1}{20}$ ) in 68 per cent.; less than  $\frac{1}{20}$  in 7, and vision was quite lost in 5. Secondary operations reduced the second class to 2, making the number of the first 93. In 1 case vision was normal; in 11, one half or more; in 27,  $\frac{1}{3}$ ; in 29,  $\frac{1}{2}$  or more; in 16,  $\frac{1}{8}$  or more; and in 11 from  $\frac{1}{10}$  to  $\frac{1}{200}$ . He never instills atropine just previous to the operation, but thinks it well to use it sometimes before to ascertain exactly the state of the cataract, and whether there be any special liability to irritation from its use. He only employs anæsthetics in exceptional cases. As he thinks it of great importance to make the incision of proper length and symmetrical as to the vertical meridian, he has devised an instrument for measuring the size of the incision and its relation to the cornea before entering the knife. To facilitate the rotation of the cutting edge of the knife forwards at the proper angle after the counter puncture, he has the middle of the handle of the knife shaped in a particular way. On the day of the operation, he has the bandage readjusted twice, and on subsequent days thrice. He administers chloral hydrate the first night or even midday if the smarting in the wound persists. Irritation in the wound is treated with ice; suppuration and iritis with warm fomentations and atropine. The bandage is continued for at least five days, and the horizontal position insisted on. Secondary hæmorrhage is treated by more frequent change of bandage, periodical application of cold, and if the blood is not absorbed, by paracentesis. He thinks that as regards operative procedures he has had the best results when he has adhered closely to the rules laid down by Graefe.

## THE STATISTICS OF THE OPERATIONS FOR CATARACT.

DR. J. HIRSCHBERG contributes a paper on this subject discussing the computation of probabilities.—("Archives of Ophth. and Otol.," vol. iv., Nos. 3 and 4, p. 452.)

## LENTICONUS.

A CASE is recorded by Dr. Webster which was under the care of Dr. Agnew. The patient was a man, *æt.* 24. The symptoms and ophthalmoscopic appearances somewhat resembled those of kerato-conus, but oblique illumination showed this was not the case. With the direct examination at about twelve inches from the eye two images of the fundus could be obtained. A central disc-like portion showed vessels which were suddenly lost, and the surrounding portion showed vessels which terminated equally abruptly towards the central portion. A representation is given. The vessels in the peripheric portion moved with the observer's head, and those in the centre in an opposite direction. By oblique illumination the lens could be seen bulging forwards in the form of a cone at its centre. (A representation is given.) There was some posterior polar cataract.—("Archives of Ophth. and Otol.," vol. iv, Nos. 3 and 4, p. 382.)

## CONGENITAL CATARACT.

MR. CRITCHETT makes some remarks on congenital cataract and its treatment. In regard to the more complete forms calling for treatment in infants, he lays stress on the fact that active pupils and clear cornea may be associated with considerable deeper defects of the eyes. On proceeding to operate with a needle, the capsule will perhaps be unexpectedly found to be very tough and the lens within it small. In such cases even when the lens and the capsule are removed, and the pupil is perfectly black and clear, there may be no useful vision. In the laminar cataracts he always performs iridectomy when practicable in preference to discision or extraction. He incises the cornea with a broad needle at the part opposite to which he intends to make the artificial pupil, draws out the iris with a hook, snips it off close with scissors, and then presses on the cornea with gentle movements of the curette, and thus causes the iris to become detached from the wound and float into the anterior chamber. In this way a very neat pupil is formed. Before practising discision, he dilates the pupil widely. He does not repeat the operation till the end of a month or six weeks. If the lens swells up suddenly, he recommends iridectomy. If fragments irritate the iris he recommends that they should be removed. He makes it a rule never to operate on both eyes at once.—("Annales d'Oculistique," Nov., Dec., 1875, p. 219.)

## THE ETIOLOGY OF ZONULAR OR LAMELLAR CATARACT.

DR. GAYET having met with two cases of zonular cataract, in which traces of previous iritic adhesions could be detected, suggests that iritis occurring at an early period while the lens is



in course of development, may give rise to a layer of opacity outside the nucleus which remains transparent, and that subsequently fresh transparent lens matter is developed around the opaque layer.—(*"Annales d'Oculistique,"* Juillet, Août, 1875, p. 55.)

#### FILAMENTOUS OPACITY IN EACH VITREOUS, CONGENITAL.

DR. WEBSTER records the following case under the care of Dr. Agnew. The patient was a young woman, *æt.* 22, who had always had and still had excellent sight. In the left eye was a filamentous body which had a dark, solid, cylindrical appearance, its anterior extremity attached to the posterior capsule of the lens at a point about one line to the nasal side of the posterior pole in the horizontal meridian, its posterior extremity fixed in the vitreous humour at a point about 1.91 mm. anterior to the retina above and to the nasal side of the optic disc, in the vicinity of a retinal vein. It appeared to be fixed in this position by an extension too transparent to be seen, attaching it to the vein, or to the adjacent retina. It was of uniform size, about that of one of the primary branches of the retina centralis, except at its extremities. During movement of the eye it executed a series of wave-like movements. When the eye was steady, the body remained fixed and formed a curved line with the concavity upwards. In the right eye there was a smaller similar opacity. There was no history of any affection of the eye, or of any subjective symptoms in connexion with these opacities.—(*"Archives of Ophth. and Otol.,* vol. iv, Nos. 3 and 4, p. 384.)

#### A CASE OF DETACHMENT OF THE VITREOUS FOLLOWED BY CURE.

DR. BRIÈRE records the case of a man, *æt.* 25, who came under care, March 17, 1875. He was myopic and had been using glasses —11. About two months previously he had noticed floating bodies before the left eye. About the middle of February this symptom became less noticeable, but in the course of a fortnight subsequently a fog came before the left eye. It increased rapidly and in the course of eight days became quite dense. On ophthalmoscopic examination it was found that the optic disc was completely obscured. The periphery was healthy, but in the situation of the disc was a greyish patch, pale grey above and gradually becoming of a deep grey below. On direct examination the patch was found to shade off gradually upwards but abruptly at other parts, especially below, being bounded by a curved margin. This grey patch seemed to project about three millimetres ('12"). No trace of the disc could be made out through the grey patch. A representation is given to

indicate what was seen. Above, the vessels passed gradually behind the patch, but below and at the sides they ended abruptly. Central vision was limited to the recognition of a lighted candle, but the extent of field peripherally seemed normal. It was at first supposed the case was one of detachment of the retina, but the appearances did not really resemble those met with in detachment, and it is almost or quite unknown for the retina to be detached in this situation. No movement of the surface of the patch could be detected nor any vessels passing over it. Dr. Brière came to the conclusion that the case was really one of the detachment of the vitreous, such as had been described by Arlt, Graefe, and others in myopic eyes. When the posterior ectasia is increasing the vitreous may not follow the coats of the eye and effusion may take place *ex vacuo* as it were behind the vitreous. Before this attack came on the patient had been copying into one book from another book, propped up at some distance, and had been looking sometimes through his glasses and sometimes without them; thus every now and then straining his accommodation. The treatment adopted consisted in the application of leeches to the temple, rest, hydragogue cathartics and nitrate of potash, followed by Gibert's syrup (ioduretted biniodide of mercury.) The disease remained stationary for two months, and then improvement was noticed in the patient's vision, and the colour of the patch became lighter. In three weeks the optic disc could just be discerned, the vessels appeared normal in size, and no trace of hæmorrhage could be detected. In August the appearances were almost normal, and at the end of September he had resumed his work for two months without fatigue and the eye had completely recovered. — (“*Annales d'Oculistique*,” Sept., Oct., 1875, p. 138.)

## GLIOMA RETINÆ.

DR. HELFREICH records a case in which both eyes were affected, and in which the lesion must have commenced at an early period of foetal life, as *the optic nerves were absent and the optic thalami of small size*. The patient was a female infant, aged eighteen months, belonging to a thoroughly healthy family. The eyes were noticed to be small directly after birth, and it was also observed that the corneæ were not of the usual circular form, and somewhat hazy. The child had no perception of light, and the eyes did not grow, so that the microphthalmos became more marked. In other respects the child seemed well developed. After death the heart was found to be malformed. At the base of the brain the second pair of nerves were wholly absent. The thalami were very imperfectly developed and scarcely distinguishable from the *corpora striata*. The eyeballs showed no traces of optic nerves. Representations of sections of the eyeballs are given. In the

left eye there was a tumour of small size situated close behind the lens, and the rest of the eyeball was filled with a dark green fluid. In the right eye there was a much larger tumour. The only portion of the retina remaining was the pars ciliaris, from which the tumours appeared to have originated. A detailed description of the various peculiarities is given. The choroid seemed unaffected.—(*"Graefe's Archiv.,"* Bd. xxi, Abth. 2, p. 236-286.)

At p. 93 of same number, Dr. Landsberg records cases. In the first of these the patient was a boy, *æt.* 3. The tumour was said to have been noticed at a very early period. Six years later he was in good health, and no return of the disease had taken place. In the second case the patient was a girl, *æt.* 6. The tumour had only been noticed a few months. For about a month the eye had been red and painful. When seen at the end of that period glaucoma was present. The eye was not removed for four months after the patient was first seen. Both halves of a transverse section of the globe are shown. The growth involved the optic nerve. Sections are figured showing growth in the septa, in the vena centralis, and in the adventitia of vessels. The choroid was quite intact. At the end of more than two years the child remained free from recurrence. Both these children were fitted with artificial eyes when about six years old. The wearing an artificial eye preserves the shape of the parts better than when the orbit is left empty. Two other cases are mentioned in which the children died. In one there were secondary growths in the cranium, and the tumour had fungated. The patient was a boy aged three. He died three months later. The other child was also a boy, four years old, who died without apparent secondary growths.

#### NEURO-RETINITIS WITH INTRA-CRANIAL BRUIT.

Dr. HOLMES, of Chicago, records the following cases:—A man, *æt.* 33, had had a loud "roaring in the head" for three years. For two years the left ear had been quite deaf; the right ear slightly so. For about eighteen months the patient had become almost blind, first in the right eye and then in the left. A loud bruit could easily be heard on the right side of the head, and pressure on the right carotid stopped it. The fundus of each eye appeared congested, and the margins of the discs indistinct. The senses of taste and smell were unimpaired. During salivation the bruit disappeared. Two years later he was in good health. He could hear the bruit at times very loudly. Not very long afterwards he died, but no post mortem could be obtained. The second patient was a boy aged six and a half. He had had obscure symptoms of brain disease for some time. There had been, for a time, double convergent strabismus, dilated

pupils, and some exophthalmos. The right eye failed first. When seen, the chief symptoms were total blindness and a peculiar aneurismal bruit in the head, which had annoyed the patient almost from the first. It could be heard most audibly above the right ear. The ophthalmoscope showed neuro-retinitis, with marked congestion of the retina; the periphery of the discs being red and obscured. The aneurismal murmur soon ceased. A cataract with detachment of retina came on in the left eye. The right disc became atrophied. The final result is not given. The third patient was a man, *æt.* 21. In January, 1871, he noticed a fulness of the head, and complete deafness in the left ear, soon followed by a peculiar intra-cranial sound synchronous with the pulse. In the following September, the sight of the left eye began to fail, and two months later that of the other also. At the end of a year neuro-retinitis was found in each. Six months later the left common carotid was tied without any marked effect on the symptoms. He afterwards complained of a very disagreeable odour. The patient died in June, 1874. He had lost the use of all the special senses. A tumour, which proved to be an enlarged pituitary gland, was found at the base of the brain, pressing on the carotid artery, and causing quite a large aneurism.—(*"Archives of Ophth. and Otol.,"* vol. iv, Nos. 3 and 4, p. 393.)

CARCINOMA OF THE OUTER SHEATH OF THE OPTIC NERVE—REMOVAL  
WITH PRESERVATION OF THE EYEBALL.

Dr. H. KNAPP records the case of a woman, *æt.* 40, who came under his care with slight protrusion of the left eyeball forwards and downwards, which had existed about six months. The optic disc was markedly swollen, and there were a number of white dots in the region between the disc and the yellow spot. (A coloured illustration is given.) The diagnosis of deep-seated orbital tumour was made. The patient was under observation for three years, and during this time the ophthalmoscopic appearances remained the same. At the end of that time it was suggested that the cause of the protrusion might be a tumour springing from the optic nerve, and it was determined to attempt its removal without enucleating the globe. An opening was made between the internal and superior recti, and the tumour reached after some difficulty. It was connected to the sclerotic by thin connective tissue, which allowed of separation. The optic nerve was divided, and then after some trouble the whole of the growth was removed, up to the very apex of the orbit. The hæmorrhage was inconsiderable. The globe was of course much displaced during the operation. The daily notes of the progress of the case are given. Part of the globe was anæsthetic, and the state of the cornea looked threatening, but recovered when the



eyelids were closed. On the third day the fundus was uniformly milky. Subsequently various vessels made their appearance. On the seventh day the milky opacity was gradually clearing up, and the condition greatly resembled that witnessed at the same date after embolism of the central artery of the retina. Subsequently the venous hyperæmia became excessive. Extravasations occurred. A representation of the state of the fundus at the end of some four months is given. There is a large white patch with processes in the situation of the disc, and on the nasal side another large patch with collections of pigment; on the outer side patches of atrophy of choroid and less pigment. At the end of eight months the condition was much the same. A detailed description of the characters of the tumour is given, and numerous illustrations are appended. It was clearly scirrhus cancer, growing from the outer sheath of the nerve. The tumour was rather more than an inch in length, and rather less in other directions. Remarks are made on the various points of interest in connexion with the case.—("Archives of Ophth. and Otol.," vol. iv, Nos. 3 and 4, p. 323.)

#### RETINITIS, SEROUS AND PARENCHYMATOUS.

Dr. DROGNAT-LANDRÉ gives the statistics of 32 cases (33 eyes) in which recent or old changes were present.—("Annales d'Oculistique," Jan., Fév., 1876, p. 50.)

#### RETINITIS PIGMENTOSA—MICROSCOPIC EXAMINATION.

Dr. PONCET records a case under the care of Prof. Perrin. The patient was a man, æt. 21, who was said to have suffered from night blindness from birth. His parents were not related before marriage, but his father, then æt. 50, had been blind at night since birth, and an uncle and a great uncle had also suffered from congenital night blindness. The patient was well developed, very intelligent, and completely blind at night. On examination his vision with the right eye =  $\frac{12}{40}$ , and with the left  $\frac{5}{40}$ . His field of vision was much diminished. At three feet distance the transverse diameter of the right field was only eleven inches, and of the left, nine inches; the vertical diameter of the right was ten inches, and of the left, nine inches. Colours were readily named. With the ophthalmoscope the changes detected consisted in an opalescent infiltration of the retina in a zone round the disc of a diameter about twice that of the disc. There was one oval spot of pigment near a vein in the right eye, and several small isolated dots of pigment, having a stellate form, in the left eye. The patient died of malignant scarlet fever, and the left eye was examined microscopically. Two figures are given showing the changes in the retina. The equatorial portion was



crowded with fine collections of pigment and some larger masses. None of them, however, had a stellate or bone-corpuscle form. This pigmentary infiltration was not in relation with the vessels at all, but was situated in the external granular layer. The fine pigment molecules were lodged in the interior of the granules. The walls of the vessels were sclerosed in many parts, but not in the immediate vicinity of the disc. The author considers that the case shows it is impossible to discover retinal pigmentary changes with the ophthalmoscope when the pigment is in the external granular layer, and not situated along the vessels. Prof. Perrin examined most carefully. The contraction of the field of vision corresponded to the peripheral infiltration of pigment. He also thinks it shows that the pigment is only of a stellate form when it is situated near the vessels. The reason for this is an anatomical one, the peculiar shape resulting from deposit in the sheath of the vessels, and not being peculiar to retinitis pigmentosa. He considers that the disease, at least as far as the pigmentation is concerned, originates in the hexagonal pigment layer of the choroid, the pigment being absorbed by the adjacent rods and cones and the cells of the external granular layer. In the present case the layer of rods and cones was unaffected.—(*Annales d'Oculistique*, Nov., Dec., 1875, p. 234.)

#### BLINDNESS FROM ISCHEMIA RETINÆ IN WHOOPING COUGH.

DR. H. KNAPP records a case, and notes that on inquiry Dr. Loomis told him that blindness in whooping cough had been observed, but almost exclusively in children who afterwards died from lobular pneumonia. The cause and nature seem to be unknown. The case narrated throws some light on the intra-ocular affection, but was also a fatal one from the cause mentioned. The patient was a child, three years of age, who after suffering from whooping cough for about six weeks, complained one day that he could not see. Both optic discs were found to be quite white. In the left eye only the main branches of the arteries were recognisable, and they were as thin as fine threads; in the right eye no arteries at all could be discerned. The veins in both eyes were scant and thin; more so in the right than in the left. It was thought the condition might be due to a hæmorrhagic effusion into the sheaths of the optic nerves, or more probably to the general anæmia and the weak cardiac action of the reduced patient. The next day paracentesis of the anterior chamber of each eye was performed with the view of reducing the extra-vascular pressure, and so favouring the weakened propulsive action of the heart. The retinal vessels became better filled, and vision improved considerably. The patient died six weeks later. No autopsy was allowed. The literature of ischæmia retinæ is quoted.—(*Archives of Ophth. and Otol.*, vol. iv, Nos. 3 and 4, p. 448.)

## A CASE OF CHOKED DISC (STAUNUNGSPAPILLA) WITH CEREBRAL TUMOUR.

THE patient was a man, *æt.* 41, under the care of Prof. Michel. The case is narrated by Dr. Herzog. Pain in the head had been complained of in 1868, five years before he came under care. A year subsequently (1869) he noticed his right hand soon became tired, and before long he began to drop things out of his hand without knowing it. In about another year (1870) pains in the buttocks and thighs and want of steadiness in his gait were noticed. There was no feeling of tightness around the loins. There was some defect of speech. In 1871 he had double vision for a time, followed by failure of sight, necessitating his relinquishing his occupation—that of a teacher—in October, 1873. He was seen soon after this. He then could not stand with his eyes shut. The right external rectus was paralysed, and there was homonymous diplopia. In other directions the globe only moved by starts. Fingers could be counted with either eye. He said bright green looked of a dirty-white colour, and red of a dirty-brown colour; violet was not recognised at all. The field of vision showed concentric contraction. He was admitted into hospital February 19th, 1874, and then became liable to epileptic convulsions, which are described in detail. The facial and fifth nerves on the right side were paralysed, and there was considerable defect of hearing. Sensation over trunk and extremities seemed normal. The ophthalmoscopic signs were those of choked disc. The diagnosis of a tumour involving the right side of the pons was made. His subsequent progress is noted. The discs became atrophied; great pain in the head was a chief symptom. He died on April 3rd, about six weeks after admission. A tumour was found pressing on the right hemisphere of the cerebellum, the right side of the pons, &c. It was a vascular growth, partly a neuroma amylenicum, and partly a sarcoma. There were also a number of fungoid tumours on the surface of the brain identical in structure with the cortical cerebral substance. The results of microscopic examination of the optic nerves, &c., are given in detail. The change during life was considered to have been *œdema*, as numerous spaces were found which had probably been filled with fluid. There was no atrophy of the nerve fibres.—(“*Zehend. Klin. Monat.*,” xiii, Juli, p. 263.)

EMBOLISM OF THE ARTERIA CENTRALIS RETINÆ DIAGNOSED FROM SYMPTOMS—HEART DISEASE—AUTOPSY TWO YEARS LATER, AND NO EVIDENCES OF EMBOLISM FOUND.

FRIEDRICH POPP narrates a case in an *Inaug. Diss.*, Erlangen, 1875. The patient was a woman, *æt.* 60. On May 18th,

1871, she suddenly became blind in the left eye while sitting in her room. The ophthalmoscopic signs were exactly those attributed by Graefe and others to embolism of the arteria centralis. The patient died October, 1873. There was disease of the heart; the vessels at the base of the brain were enlarged and calcareous. The left optic nerve and tract were atrophied. The vessels in the nerve were carefully examined, but nothing was found to warrant the supposition that embolism had occurred.— (“Zehend. Klin. Monat.,” xiii, Aug., p. 305.) See also Dr. Gowers’ case further on.

## CHOROIDITIS.

DR. DROGNAT-LANDRÉ gives the statistics of 37 cases of choroiditis. The notes of the individual cases are not given, but the numbers coming under each group discussed are quoted. The paper goes into great detail, and we can only select the following points:— In 13 both eyes were affected, and in the remaining 24 only one eye, so that the statistics include 50 diseased eyes. The age of the patients ranged from fifteen to fifty-four years; the greatest number were between eighteen and thirty-five. The yellow spot was affected in 27 eyes—in 8 alone and in 19 associated with patches in the periphery. When the yellow spot alone was affected, there was mostly only one patch. The optic disc was normal in 18 eyes and pale in 25. In 30 eyes there was some affection of the vitreous. In only 6 was there evidence of iritis. In 7 there was punctate keratitis. In 10 cases and 14 eyes syphilis was known to be the cause; in 4 cases (4 eyes) there was hereditary syphilis; in 2 cases (3 eyes) there was a consanguineous marriage; in 2 cases (3 eyes) the affection was congenital, but the cause was unknown; in 1 (2 eyes) there was a hereditary tendency, the mother having choroiditis; in 1 there had been an injury, and in 18 (23 eyes) no cause could be assigned. In one-half the cases, (and eyes,) therefore, the cause was unknown; in one-fourth syphilis was assigned; and of the 10 patients affected with syphilis, in 4 both eyes were attacked, and in 6 only one; in 2 of the latter iritic adhesions were present in the other eye. Of the 4 patients probably affected with congenital syphilis, only one showed a definite symptom, and that was ulceration of the soft palate occurring at the same time as the choroiditis. Other points dealt with are the age of the patients, nature of the choroidal change, its duration, the layers of the choroid affected, the form, number, and size of the patches, seat of the changes, colour of the patches, difference in level between the patches and the other parts of the fundus, complications as regards optic disc, vessels, retina, vitreous, influence of seat of choroiditis on vitreous opacities, iris, cornea, etiology, development, influence of development on affection of vitreous, connection between development and etiology, acuity of central

vision, influence of choroiditis at the yellow spot on central vision, influence of such disease limited to the yellow spot on central vision, influence of peripheral affection on central vision, influence of the seat of the choroidal changes on central vision, acuity of central vision, &c.—(*"Annales d'Oculistique,"* Sept., Oct., 1875, p. 170.)

#### THE TREATMENT OF CHOROIDITIS DISSEMINATA.

DR. BONWETSCH and Dr. Schmemmann note improvement in cases of long-standing choroiditis from the use of injections of strychnia. In recent cases they have not found any good result follow.—(*"Zehend. Klin. Monat.,"* xiii, Sept., p. 319.)

#### GREAT DEFECT OF SIGHT DUE TO GROWTHS FROM THE TRANSPARENT MEMBRANE OF THE CHOROID, AND CRYSTALLINE DEPOSITS OF CARBONATE OF LIME ON THE INNER SURFACE OF THE CHOROID.

PROF. A. NAGEL records the case of a woman, æt. 64, who came under his care with great defect of sight of twelve months duration. On examination with the ophthalmoscope, peculiar changes were found in each eye in the region of the yellow spot. There were a number of small spots of a whitish-yellow colour tending to become confluent. Amongst these were a number of isolated points which reflected light strongly. They were especially evident on examination in the erect image, and it was noticeable that only those glistened markedly on which light was thrown. They resembled crystalline masses. The patient died eight years later, and the eyes were carefully examined. A detailed description of the conditions present is given. On the inner surface of the choroid were a number of small hard elevations, which were found to consist of carbonate of lime. Remarks are made on the cases previously recorded of suspected occurrence of cholestearine in the fundus of the eye. It is suggested that in some of these the glistening masses may have been carbonate of lime. The growths from the elastic lamina of the choroid may have been simply due to senile changes, such as occur in other elastic structures of the eye. Two other cases are mentioned of a somewhat similar character.—(*"Zehend. Klin. Monat.,"* xiii, Sept., p. 338.)

#### DISEASES OF THE EYE ASSOCIATED WITH DIABETES.

PROF. TH. LEBER has an important paper on this subject in *"Graefe's Archiv. für Ophth.,"* xxi, 3, p. 206. He first of all gives an account of the history of the recognition of the connexion between diabetes and various defects of sight. It was a long while before diabetic cataract was generally acknowledged, and though that is now treated of in all text books on diseases of the



eye, other affections are either passed over in silence or their connexion with diabetes disputed. In reviewing the cases recorded, however, it will be found that defects of sight are very common in the subjects of diabetes. Very different effects have been noted in different cases; paralysis of accommodation, hæmorrhages into the retina and vitreous; retinitis apoplectica, with and without white patches; amblyopia without ophthalmoscopic changes, with normal field of vision or with contraction of field; hemiopia and atrophy of the optic nerves; paralysis of the ocular muscles; suppurative keratitis, double iritis. Jaeger (in 1856) in his atlas was the first to give a pictorial representation of retinitis attended with apoplexies and white patches associated with diabetes; Desmarres subsequently recorded several cases of amblyopia with and without ophthalmoscopic changes, and Galezowski in his "*Traité des Maladies des Yeux*" gave a detailed account of the matter, and recorded fresh cases. Under the head of "*Retinal Affections in Diabetes*," Prof. Leber quotes eighteen recorded cases, (for one of these see preceding periscope,) and narrates the case of a woman, *æt.* 51, who was under his care at various times, from May, 1874, to September, 1875, with sugar and albumen in the urine. During the summer before she came under care, she had noticed a mist and dark coloured muscæ before the right eye, the left remaining good. The fundus could be seen with difficulty. There were floating bodies in the vitreous. The disc could not be recognised. In the situation for it was a large white shining patch of irregularly oval shape, and crossed by a few fine vessels. It seemed to project forwards. From it there branched out several white streaks. At another part of the fundus there was also a small white spot. The retinal vessels could only be indistinctly seen in places. Though the vision of the left eye was good, there were a number of small extravasations on the outer side of the disc, near the yellow spot. The disc itself had a peculiar appearance from extravasation. The amount of sugar, &c., is noted from time to time. The conditions ophthalmoscopically remained much the same till October, when the left eye failed more and blood clots could be seen near the disc, concealing vessels in places. There was no white spot. The small extravasations remained. In January a peculiar white patch was visible on the disc and adjacent to it (a figure is given). The conditions at this date are given in detail. Near the yellow spot were a number of white spots. The opacity of the vitreous varied from time to time. At one period great improvement followed the administration of carbolic acid, and the sugar disappeared. A table of the state of urine, sight, &c., during April and May, 1875, is given. In September there was still no sugar in the urine, but vision had deteriorated. In discussing this series of cases, remarks are made on the connexion of the retinal and vitreous changes with



the diabetes. In a second group he collects cases of affections of the optic nerve in diabetes. (1) amblyopia without ophthalmoscopic changes; after quoting a number of recorded cases, he narrates three others under his own care. The first patient was a man, *æt.* 43, suffering from amblyopia affecting both eyes, the left failing first. The urine contained sugar, but no albumen. Improvement in vision resulted and the sugar disappeared. He was seen four years later. The next patient was a man, *æt.* 50. The third patient was 73 years of age. He had hemiopia. The notes are given in great detail. (2) hemiopia. Three cases are quoted and his own case referred to, which is given under the preceding category. (3) atrophy of the optic nerves. Cases are quoted. Remarks on the subjects are made, and the connexion of the diabetes and atrophy with some central lesion discussed. A central lesion may co-exist with and yet not cause the diabetes. He thinks the majority of the cases in which affections of the optic nerves are associated with diabetes show no direct connexion with cerebral mischief. In a third group are collected cases of paralysis of ocular muscles, associated with diabetes. (1) paralysis of accommodation with mydriasis. (2) paralysis of the extrinsic ocular muscles. Fourthly, the author treats of sugar in the eye itself, and the chemical reaction of the fluids of the eye in diabetes. In some concluding remarks, attention is called to the fact that when ocular affections depend on diabetes the general symptoms of the latter may be absent, or at any rate very slight, and that the urine should be examined systematically in eye affections; and further, that we should not be content with one examination only. As to treatment, he thinks that if the diabetes is discovered early, proper diet, &c., will have a good effect. In one case carbolic acid evidently acted well, in two others improvement had commenced before its use, and in a fourth it had no effect.—(*"Graefe's Archiv.,"* Bd. xxi, Abth. 3, p. 206-337.)

#### A CASE OF MONOCULAR AMAUROSIS (TOTAL) OCCURRING DAILY.

THE patient (a woman) was thirty-one years of age, and had four children. For several evenings in succession she became blind of one eye for some hours, (until the morning,) after which she could again see. After the administration of quinine the attacks became gradually deferred later and later, and then ceased. The case is recorded in detail by Dr. Königstein.—(*"Zehend. Klin. Monat.,"* xiii, Sept., p. 333.)

#### AMAUROSIS, WITH SUDDEN STOPPAGE OF MENSES IN CONNECTION WITH WET FEET—RECOVERY.

THE patient was a young woman, under the care of J. Samelsohn. The blindness came on suddenly on the sixth day. The ophthal-

microscopic examination gave a negative result. Four days subsequently improvement commenced, but the menses did not return for seven weeks, and vision was not perfect for a month or more.—(*"Annales d'Oculistique,"* Nov., Dec., 1875, from *"Berl. Klin. Wochensch."*)

#### THE MACULÀ LUTEA.

DR. HERM. SCHMIDT-RIMPLER describes the anatomy and ophthalmoscopic appearances of the yellow spot. Ophthalmoscopically the spot is not yellow, though it is so after death. He finds that quite recent retinæ show the same appearances as those visible by the ophthalmoscope. The yellow colour does not appear as long as the retina is quite transparent, it only gives rise to a darker colour at this part. It is not due to the retina being thin, or to the choroid having a deeper pigmentation. He does not find that the retina forms a pit or depression at the yellow spot.—(*"Graefe's Archiv,"* Bd. xxi, Abth. 3, p. 17.)

#### THE ETIOLOGY OF GLAUCOMA.

DR. M. LANDSBERG records cases in which glaucoma appeared to come on secondarily in connection with vascular degeneration. He also considers that any sudden impediment to the venous circulation in old persons is liable to excite glaucoma provided that the power of absorption of fluids be diminished owing to vascular disease. With disease of vessels, a slight increase of fluid within the eyeball, any disturbance of the normal relation between secretion and absorption is liable to set up glaucoma. A detailed microscopic examination of one eyeball is given in which hæmorrhages preceded glaucoma. His cases illustrate the causal connection between increase of the general blood pressure and glaucoma with pre-existing intra-ocular (retinal) disease of vessels whether the increase of the general blood pressure be due to primary disease of the vascular apparatus or some respiratory affection. He thinks that not only what is generally called secondary glaucoma may depend on such causes, but that true inflammatory glaucoma also often does.—(*"Graefe's Archiv,"* Bd. xxi, Abth. 2, pp. 67-91.)

#### OBSERVATIONS ON THE VISION POSSESSED BY A CHILD SUCCESSFULLY OPERATED ON FOR DOUBLE CONGENITAL CATARACT.

DR. A. V. HIPPEL gives an account of the amount and kind of vision possessed by a girl, æt. 4, suffering from cataract both before and after operating. She was taught to recognise certain objects by feel, to know what was meant by round, etc., and then the way in which she could or could not recognise these objects is

noted after she could see. There was great difficulty in estimating the distance of objects and the relative size. The child had nystagmus. After the operations she was able to recognise even slight differences of colour.—(*"Graefe's Archiv.,"* Bd. xxi, Abth. 2, p. 101-131.)

#### THE PERCEPTION OF COLOUR IN DISEASES OF THE OPTIC NERVE.

E. RAEHLMANN publishes observations on this subject. He uses the spectrum, and either shows the patient all the colours at once, or isolates any particular colour by means of slits, and varies the illumination. He also tests whether the spectrum seems shortened at one end or not. If a patient can recognise all the colours of the spectrum, and the latter appears of its full length, there is no need to examine further. Different degrees of illumination, however, may be tried. If any defect is discovered, then careful observation is made as to whether different colours appear the same to the patient, yellow and green for instance. This may occur even when all the colours of the spectrum have been told off in succession correctly. Another test is to show two colours recognised as distinct, and then leaving one colour (red, say) still visible, find at what part of the spectrum intervening a colour occurs which appears the same (as the red.) Another test is to begin with a very feeble illumination, and gradually increase it till colour can be perceived. This amount of illumination may then be compared with that required by a normal eye. The author tests the periphery of the retina by selected pigment colours under an uniform illumination. The perception of colour, in affections of the optic nerve, closely resembles that of the periphery of the normal eye. When the defect is extreme, two colours only are perceived, and the greatest sensitiveness remains for yellow. He considers that a certain deficient sensitiveness for colour is pathognomonic of atrophy of the disc, and of the latter there are two forms. In the marked atrophy, with well-defined disc, there is always a deficient perception, but in the form dependent on choroidal peripheral retinal changes it does not always occur. In retinitis pigmentosa he has never met with deficient perception of colour. In amblyopic conditions, attributed to alcohol and tobacco, he has not found deficient perception till atrophy ensued. Yellow and green are generally the first to be confounded. Commonly green is said to be white. With a strong light, two colours may be perceived, generally yellow and blue, and with a moderated light, three may be recognised, red, yellow or green, and blue. In a feeble light no colours at all. When colours are tried separately, red, yellow and green, and blue and violet may be confused. In very advanced atrophy, the whole spectrum may simply be seen as a bright light. He narrates various cases which he

could watch for some time, and records in detail his observations.—(*"Graefe's Archiv.,"* Bd. xxi, Abth. 2, pp. 27–66.)

#### THE DETERMINATION OF THE PERCEPTION OF COLOURS.

DR. G. LANDOLT recommends the use of Maxwell's revolving disc in such a way that the amount of colour requiring to be added to white in order to be recognised may be estimated. This gives an idea of the degree of colour blindness present.—(*"Annales d'Oculistique,"* Juillet, Août, 1875, p. 74.)

#### CHROMATOPSEUDOPSIA.—COLOUR BLINDNESS.

DR. WARLOMONT's article on this subject contributed to the *"Dictionnaire Encyclopédique des Sciences Médicales,"* is reprinted in the *"Annales d'Oculistique,"* Juillet, Août, 1875, p. 5. A copious bibliography is given.

#### THE DETERMINATION OF THE FIELD OF VISION.

DR. HIRSCHBERG points out the best and correct method of recording the field of vision obtained either by testing on a flat board or by a perimeter. When taken on a flat surface, the angles corresponding to the linear magnitudes obtained may be known from tables given, and conversely the angles obtained by the perimeter may be compared with the observations on a flat surface. The results obtained by the perimeter should be recorded on a kind of clock-face with concentric circles, the outer ones of which should be closer together than those nearer the centre. The reasons for this and the mode of constructing such are given.—(*"Archives of Ophth. and Otol.,"* vol. iv, Nos. 3 and 4, p. 366.)

#### THE FIELD OF FIXATION.

DR. SCHNELLER details observations on the field of fixation, that is, the area over which distinct vision is possible while the head is fixed and the eyes allowed to move. He uses Förstor's perimeter slightly modified, so as to ensure better fixation of the head. He tests the range of vision in each direction by means of the smallest type the patient can read. From above downwards the range is about  $94^{\circ}$ , and from side to side  $85^{\circ}$  to  $90^{\circ}$  at 12" distance. He gives diagrams of the fields in myopia, hypermetropia, astigmatism, and paralysis of muscles. In a case of paralysis of the external rectus, the gradual improvement from time to time is well shown. He has experimented on the tendency the eyes have to diverge in looking upwards and converge in looking downwards, and the tendency in divergent strabismus for the eye to deviate upwards as well and in convergent stra-

bismus to deviate downwards. He has also estimated the power of internal recti in convergent strabismus, and of the external in divergent squint, and comes to the conclusion that there is no increased action on the part of these muscles. Hence the advisability of advancing the weak muscle instead of simply dividing the apparently too powerful one. He makes some observations on the mode of occurrence of various forms of strabismus, and finally describes the plan of bringing a muscle forwards. He finds two threads sufficient, one above and one below, and tightens them alternately till he gets the desired result. He prefers to test the patient's vision as he is doing this, to see whether there is any diplopia, or causes it by a prism to see if the images lie one above the other.—("Graefe's Archiv," Bd. xxi, Abth. 3, pp. 133-198.)

#### ON THE DETERMINATION OF THE FIELD OF FIXATION.

DR. J. HIRSCHBERG writes on this subject. He says the same principles that govern the determination of the monocular field of vision hold good for a simple representation of the conditions of the binocular field of fixation (Blickfeld). They furnish a sure basis of comparing, in a simple and objective manner, the motility of the eyes of different persons, as well as the motility of the eyes of the same person at different periods, for instance, before and after the operation for strabismus, provided that both eyes have good sight, and binocular vision be either preserved, or has been re-established. If we aim at elevating the treatment of squint over the mere cosmetic standard of removing the deformity to the dignity of a radical cure, physiological principles must guide us in determining accurately the correction of the diplopia by operation, the choice of glasses and ocular gymnastics. For that purpose it is necessary to know the mechanical conditions of the position of the eyes relative to every point in the field of fixation, and we must be able conveniently to survey these conditions. The field of fixation common to a pair of normal eyes is a part of the surface of a sphere, the centre of which bisects the basal line, (*i.e.*, the union between the points of rotation,) and the radius of which is arbitrary. Only that part of the common field of fixation, the centre angle of which,  $= 80^\circ$ , is, in binocular fixation, ordinarily travelled over by the crossing point of the two lines of fixation. Extreme lateral and vertical movements are supplied by rotations of the head. Patients suffering from binocular diplopia are always satisfied when their common field of fixation obtains an aperture of  $2 \times 30^\circ$ , in which they see single. Before operation we should more accurately examine the character of the diplopia, at least in some principal points of the field of fixation. For this purpose the field of fixation, divided into degrees, is projected on a vertical plane, tangent to



the vertex of the sphere of the field of fixation. A suitable wall of an examining room is chosen and divided into spaces which are indicated in a particular way, (for which refer to the paper.) The patient is placed at 2 metres distance (about 6 feet) from the wall, and his eyes at the level of 1.16 metres (about 4 feet) from the floor, this level being the point from which the measurements proceed. The distance of 2 metres (radius of field of fixation) is chosen because, if the patient is too close, the results are liable to error, and if too far off the wall will not be sufficiently large. A table of comparison between linear magnitudes and angles of the vertical and lateral deviations is given. Strips of paper are pasted over the lines on the wall, so as to be quite evident. In testing diplopia, a strip of red glass is held before one eye and a light is held at the principal points of the mapped-out field, and the patient mentions where the images are in reference to the spaces. In manifest diplopia, trial should be made without the red glass as well as with it. The author also discusses the use of prisms in measuring diplopia. He concludes that prisms are more serviceable in determining the tendency to fusion than the degree of the deviation. Instead of the plan of determining the field of fixation which he lays down, he also recommends an instrument on the principle of Carter's perimeter. The radius of curvature of the graduated arm is 1 metre (3.2 feet) in length; it goes from  $0^\circ$  up to  $40^\circ$ ; in  $0^\circ$ ,  $10^\circ$ ,  $20^\circ$ , and  $40^\circ$ , there are secondary arms,  $20^\circ$  in length, cut from the surface of the same sphere, having a radius of 1 metre. The zero point of the principal arm is fastened to a stand 1.16 metres (4 feet) above the floor, but may be moved a certain distance up and down; the arm may be fixed at any inclination to the horizon, and the secondary arms at any inclination to the principal one. Thus the diplopia is measured at definite points in the sphere of the field of fixation directly by degrees of the sphere, whereas the above measurements were made in the tangent plane of the field of fixation. This is in perfect analogy with the determination of the field of vision.—("Archives of Ophth. and Otol.," vol. iv, Nos. 3 and 4, p. 372.)

#### POSITION OF THE GLOBES WHEN THE LIDS ARE CLOSED.

DR. HOLMES, of Chicago, says that when he fixes his eyes on a small black object placed on a white blank wall, or a very small isolated gaslight in a dark room at the distance of twenty feet or so, then closes the lids for a moment, endeavouring mentally to fix the eyes on the object, and finally opens them suddenly, he perceives two images, one directly above the other and about a foot or more apart. These images afterwards coalesce. If the head is turned to either shoulder, the images still appear perpendicular to the line joining the centre of the two pupils. When

the eyes are tired or the muscles weakened by inhaling a small quantity of chloroform, the effect is greater. A coloured glass renders the images more distinct, and the image from the left eye is above the other. The two eyes are practically normal, but the right one remains blind for some time after the other, on passing at once from daylight into a dark room. It seems that in certain individuals the inferior and superior, and possibly the oblique, muscles are unequally relaxed when the lids are closed. He has found similar phenomena occur in three out of eleven of his friends who have tried the experiment.—(*"Archives of Ophth. and Otol.,"* vol. iv, Nos. 3 and 4, p. 408.)

#### HOW THE MOVEMENTS OF THE EYES MAY BE UTILISED IN DIAGNOSTICATING ONE-SIDED BLINDNESS.

DR. H. KNAPP records the case of a young lady who said she was blind of one eye, and remarks on the diagnosis of unilateral blindness. He thinks too little attention has been called to the fact that the position and movements of both eyes, in monocular and binocular vision, can be utilised for this purpose. The binocular fixation should first be tested, and if this is normal it is quite improbable that one eye is blind. The eye represented as blind may then be alternately covered and uncovered while the object of fixation is made to approach or recede before the eye. This test may be confirmed by the use of a prism, say  $12^{\circ}$ , with base outwards, before the "blind" eye, and notice whether this eye moves towards the nose. If so, the images are fused. Then withdraw the prism and see if the eye moves outwards to fix again. The case he narrates was that of a lady, *æt.* 18, who first of all complained of spasms in the eyelids, photophobia, and weakness of sight in both eyes. There was also spasm of accommodation and concentric limitation of field, (retinal anæsthesia, Graefe.) The field of the right eye remained permanently contracted to point of fixation, but the left varied. After eighteen months she said she could no longer see with the right eye. There was no objective evidence of such being the case. The stereoscopic test gave no result. Binocular fixation was good. When the good eye was covered she did not follow any object with the other eye, but when covered and then exposed the (blind) eye was always direct to an object 2 feet or more distance. The nearer the point of fixation was the more the eye behind the concealing hand was turned outward, but when the hand was removed the eye at once fixed the object. The prism test caused no diplopia, but the eye moved just as if vision were perfect. When a prism ( $7^{\circ}$ ) was held base downwards before either eye, it prevented her reading small print. The affection lasted till time of record (three years) without change. The patient is well developed and looks healthy. There is

dysmenorrhœa. Simulation could only be the result of a freak. Can the phenomena be explained by assuming that the visual impressions made on the right eye are not perceived, whereas they co-operate in binocular vision? Double images may be present without being recognised in healthy eyes. The strongest proof of simulation was the reading test. Displacement of the eye by pressure produced no diplopia. Cuignet's test trapped her. When a rod about half an inch in thickness was held before her face in such a direction that it came exactly in a line between the healthy eye and the printed page, the patient read without difficulty and without moving her eye or the book.—("Archives of Opth. and Otol.," vol. iv, Nos. 3 and 4, p. 361.)

#### A NEW OPHTHALMOSCOPE AND OPHTHALMOMETER.

DR. EDWARD O. SHAKESPEARE describes and figures ("Am. Journ. Med. Sci.," Jan., 1876) a new ophthalmoscope and ophthalmometer. It may be used as a portable or fixed ophthalmoscope, and for the erect or inverted image. As an ophthalmometer it is designed to determine the refraction of the eye rapidly and correctly; to measure the distance of the retina behind the nodal point, and the actual as well as the relative size and position of any fixed visible object within the eye; to estimate and render possible the more perfect correction of certain forms of astigmatism which have been classed as irregular and irremediable; to measure the radius of curvature of the cornea in the different meridians; to recognise the coincidence or want of coincidence of the axis of the lens with that of the cornea, and, if there be any deviation, to estimate the degree of eccentricity of their reflecting surfaces; and to determine the position of the iris in reference to the cornea.

#### A PERIMETER AND SCHEMOGRAPH.

DR. BADAL makes some observations on the different methods adopted for measuring the field of vision, and describes and figures a portable (or fixed) perimeter which is convenient and accurate in practice, and will measure the most extensive or most contracted field. It consists of an arc (graduated) of a circle and having an ivory knob movable on it. The arc can be rotated around an axis so as to be opposite any meridian of a disc placed behind it. This axis consists of a tube, and its length is the same as the distance at which the patient's eye is placed from the arc. The end opposite that to which the arc is attached is expanded into a kind of shallow cup, and the patient places his eye against it. The side of the tube overhung by the arc has a slit in it, through which the patient perceives the

knob as it travels on the arc. The patient having shut one eye places the other against the expanded end of the tube and looks down it at some object, (say a wafer on the wall,) the tube being held horizontally in the hand or fixed by a support to a table. At the same time that the patient looks straight down the tube with the centre of his field, the peripheral portion can be tested by the knob moving along the arc. In addition to this perimeter, a schemograph is figured and described, and remarks are made on the incorrectness of the methods in general use of representing the measurement of the field of vision obtained by the perimeter, &c. The schemograph consists of two plates connected by a hinge like two leaves of a book. The anterior has a semi-circle (movable) on it, and graduated so that one half may be used to note the tangents of the angles detained by the perimeter, and the other half represents the "development on a plane surface of the arc of a circle taken on a scale of double the arc of the retinal circle," that is, 4 metres represents  $10^\circ$ . A piece of paper being placed between the two plates the field may be marked on the paper with the aid of the semi-circle.—("Annales d'Oculistique," Nov., Dec., 1875, p. 259).

A NEW OPTOMETER GIVING QUICKLY AND AT THE SAME TIME THE STATE OF THE REFRACTION OF THE EYE AND THE ACUITY OF VISION.

A NEW optometer devised by Dr. Badal, has been presented to the Société de Chirurgie de Paris, by Dr. Giraud-Teulon, and is described by him in the "Annales d'Oculistique" (Jan., Fév., 1876, p. 5). It consists of a test object which can be moved to and fro, and of a single bi-convex lens placed at its focal distance from the anterior focal point of the lenticular system of the eye. It is founded on the fact that if two centred lenticular apparatus be associated so that the posterior principal focus of the first shall coincide with the anterior principal focus of the second, whatever may be the indices of refraction of the extreme media, the parallel rays in the first medium will still be parallel in the last. In such a combination an object placed in the first medium at the anterior focus of the lens gives rise to parallel rays. These rays in the second medium will come to a focus at the posterior focus of the second system. As the object is moved towards the lens, the rays will present every variety of divergence, and as it is withdrawn from the lens (and its anterior focus) every variety of convergent rays. The former position of the object will correct and estimate any variety of myopia, if the space between the anterior focus and the lens be graduated; and at the same time the acuity of vision may be tested, and the latter position will apply to hypermetropia.

The lens chosen is about  $2\frac{1}{2}$  in. focus, and the object is a

reduced photograph of Snellen's type. The size of the image will not vary with the position of the object.

THE DECUSSATION OF THE NERVE FIBRES IN THE CHIASMA.

PROF. GUDDEN describes and figures a preparation from a dog, showing partial decussation. — ("Graefe's Archiv," Bd. xxi, Abth. 3, p. 199.)

THE STATE OF REFRACTION OF THE EYES OF 529 SCHOOLMASTERS,  
FROM FRENCH, GERMAN, AND SWISS CANTONS.

DR. PFLÜGER.—("Zehend. Klin. Monat.," xiii, Sept., p. 324.)

THE HYPERBOLA OF ACCOMMODATION.

BY PROF. HASNER.—("Zehend. Klin. Monat.," xiii, Aug., p. 289.)

ON THE ESTIMATION OF THE POINT OF ROTATION OF THE EYEBALL.

DR. LEOPOLD WEISS.—("Graefe's Archiv," Bd. xxi, Abth. 2, p. 132.)

ON ROTATION OF THE EYE.

DR. W. SCHOEN. Second communication.—("Graefe's Archiv," Bd. xxi, Abth. 2, p. 205-212.)

THE LAW OF THE ROTATION OF THE EYEBALLS IN ASSOCIATED  
MOVEMENTS.

DR. GIRAUD-TEULON.—("Annales d'Oculistique," Sept., Oct., 1875, p. 113-138.)

THE CORRESPONDING RETINAL MERIDIANS AND SYMMETRICAL MOVE-  
MENTS OF ROTATION.

BY F. C. DONDERS. An isoscope is figured and described by which the angle of the apparent vertical and horizontal or other meridians may be estimated either separately or in conjunction under various degrees of convergence, &c.—("Graefe's Archiv," Bd. xxi, Abth. 3, p. 100.)



## CASE OF SIMULTANEOUS EMBOLISM OF CENTRAL, RETINAL AND MIDDLE CEREBRAL ARTERIES.

DR. GOWERS records the case of a man, æt. 30. He had right hemiplegia and other symptoms. Five days after the onset of the paralysis, ophthalmoscopic examination (inverted image) showed the right fundus to be normal, whilst on the left side the disc could not be distinguished, being veiled by a greyish-white cloud. There was another white cloudy opacity of considerable size near the yellow spot. During the next week these white patches gradually lessened. The diminished size of the arteries became distinct. In three weeks the large white patch at the yellow spot had disappeared. The outer half of the disc remained somewhat hazy. Ten days later the arteries on the disc seemed to be the merest threads; at a distance from the disc they increased in size. He died at the end of two months. There was softening, &c., in the left hemisphere, involving fissure of Sylvius, &c. In the left middle cerebral artery was a clot half an inch long, colourless, and firm. Examination of the optic nerve, &c., on the left side showed the central artery in the nerve reduced to a mere line. There was an elongated plug formed of a granular mass about one eighth of an inch behind the lamina cribrosa; it did not quite fill the vessel, having probably shrunk. A wood-cut is given. In remarking on the case, Dr. Gowers observes there could be no doubt as to its nature, but he did not think that the plug figured was the one which had effected the closure of the central artery; it was too small, and there was no narrowing of the vessel at the spot to account for its arrest, and the artery was narrowed behind it almost as far as its entrance into the nerve. No plug could be found before it entered the nerve. The chief obstruction was probably where the artery entered the nerve. The collateral circulation was soon established, as the ophthalmoscopic examination showed that the arteries soon increased in size after leaving the disc. The red spot so often noticed at the macula was not present in this case, whilst there was early infiltration around the disc, points which have been supposed to indicate hæmorrhage in the neighbourhood of the nerve rather than embolism. ("Lancet," 1875, vol. ii, p. 794.)

## THE LENGTH OF THE EMMETROPIC EYE.

DR. J. HIRSCHBERG (Centralblatt, f. d. M. W., January 15, 1876) gives the measurements of an eye-ball which he had to enucleate, and the refraction of which he had previously ascertained to be normal. The optic axis measured 23·75mm. (.935 inch), and

from the anterior surface of the cornea to the layer of rods and cones of the retina about 23mm. ( $\cdot 9$  inch). Prof. Becker estimates the length of the optic axis to be 23·86 mm. In the diagrammatic eye of Listing and Helmholtz, the optic axis measures 22·23 mm. ( $\cdot 875$  inch), which appears to be rather too low an estimate. Jaeger gives the length of the eye-ball (including the sclerotic) as 24·3 mm. In an eye-ball which before removal appeared to be hypermetropic  $\frac{1}{30}$  both on testing with lenses and with the ophthalmoscope, the length of the optic axis was 23 mm. This is the first instance on record of exact measurement of an hypermetropic eye-ball after removal.

THE INTRODUCTION OF THE METRICAL SYSTEM INTO  
OPHTHALMOLOGY.

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1. The numbers by which the glasses of the old system are designated indicate *in inches the radius of curvature of the lens*; and since for the index of refraction which these glasses have, the centre of curvature coincides very nearly with their foci, the numbers at the same time indicate their *focal distances*.

Thus: If we take a convex lens and form with it an image of a window on the opposite side of the room, we find that the distance which separates the image from the lens, expressed in inches, corresponds to the number of the lens.

2. The *refracting power* of a lens being the *reverse of its focal distance*, is represented by a *fraction* of which the numerator is 1, and the denominator its focal distance; thus: No. 5 has a focal distance of 5 inches and a refracting power of  $\frac{1}{5}$ , No. 10 has a refracting power of  $\frac{1}{10}$ , No. 12,  $\frac{1}{12}$ , &c.; a fifth, a tenth, a twelfth, of what?—Of a lens ( $\frac{1}{1}$ ) which has a focal distance of 1 inch.

3. The *unit* of the old system is therefore represented by a lens which has a focal distance of one inch. This lens is not found in our trial cases. We do not use it in practice, because it is stronger than we have need for. We have only need of lenses more feeble than the unit, and for this reason

all our glasses are represented by a fraction of this unit. (If we had need of a lens of  $\frac{1}{2}$  inch or  $\frac{1}{4}$  inch, these lenses would be represented by the fractions  $\frac{1}{4}$  and  $\frac{1}{2}$ , that is to say, by the whole numbers 2 and 4.)

This is an inconvenience, because all combinations of the lenses must be made by the addition and subtraction of fractions. The unit is therefore too strong.

4. But this system of numbering has yet other inconveniences.

*The inch is not a uniform measure*, corresponding to a magnitude universally adopted. It is a measure arbitrarily chosen, and is different in different countries. Thus we have the English, Parisian, Austrian, Prussian, and many other inches, all of which differ materially.

1 Paris inch = 27·07 mm.

1 Rhenish „ = 26·15 mm.

1 English „ = 25·40 mm.

According to these different measures are the glasses manufactured in each country respectively. A lens No. 5 made in France is therefore not the same as a No. 5 English, Austrian, or Prussian lens.

5. A third inconvenience is that the intervals between the different numbers of the old series of glasses are unequal, and what is of more importance, it is difficult to calculate these intervals, because the calculation must be made by the subtraction of fractions.

Here is the series of the old system, with the intervals between the different glasses.

| Nos. | Inter-vals.     | Nos.           | Inter-vals.     | Nos.           | Inter-vals.    |
|------|-----------------|----------------|-----------------|----------------|----------------|
| 72   | $\frac{1}{360}$ | 14             | $\frac{1}{182}$ | $5\frac{1}{2}$ | $\frac{1}{55}$ |
| 60   | $\frac{1}{240}$ | 13             | $\frac{1}{156}$ | 5              | $\frac{1}{45}$ |
| 48   | $\frac{1}{366}$ | 12             | $\frac{1}{132}$ | $4\frac{1}{2}$ | $\frac{1}{36}$ |
| 42   | $\frac{1}{252}$ | 11             | $\frac{1}{110}$ | 4              | $\frac{1}{28}$ |
| 36   | $\frac{1}{180}$ | 10             | $\frac{1}{90}$  | $3\frac{1}{2}$ | $\frac{1}{45}$ |
| 30   | $\frac{1}{120}$ | 9              | $\frac{1}{72}$  | $3\frac{1}{4}$ | $\frac{1}{39}$ |
| 24   | $\frac{1}{120}$ | 8              | $\frac{1}{56}$  | 3              | $\frac{1}{33}$ |
| 20   | $\frac{1}{180}$ | 7              | $\frac{1}{91}$  | $2\frac{3}{4}$ | $\frac{1}{27}$ |
| 18   | $\frac{1}{144}$ | $6\frac{1}{2}$ | $\frac{1}{78}$  | $2\frac{1}{2}$ | $\frac{1}{22}$ |
| 16   | $\frac{1}{240}$ | 6              | $\frac{1}{66}$  | $2\frac{1}{4}$ | $\frac{1}{18}$ |
| 15   | $\frac{1}{216}$ | $5\frac{1}{2}$ |                 | 2              |                |
| 14   |                 |                |                 |                |                |

6. It was to remedy these inconveniences, that a Commission\* was appointed by the International Ophthalmological Congress, at Paris, in 1867. At the Congress of Ophthalmologists which assembled at Heidelberg in 1875, as well as at the International Medical Congress which met at Brussels in the same year, a new system was unanimously adopted, of which the following are the principles:—

- (a)—*The substitution of the metre for the foot as a basis for numbering glasses.*
- (b)—*Numbering the glasses according to their refracting power, and not by their focal distance.*
- (c)—*The choice of a unit sufficiently feeble, so that the*

\* This Commission was composed of Giraud-Teulon, Javal, Nagel, Leber, Donders, Soelberg Wells, Quaglino, and O. Becker.



*numbers of the lenses generally in use may be expressed in whole numbers and not in fractions, the interval being as far as possible the same between the different numbers.*

7. The *unit* of the new system, the No. 1 of the new series of glasses, is a lens with a focal distance of *one metre*.\* It is called a DIOPTRIC (*D*).† Its refracting power is therefore expressed by the fraction  $\frac{1}{1\text{m.}}$ . No. 2 is a lens which has *double* the refracting power ( $\frac{2}{1\text{m.}} = 2D$ ). No. 3 has *three* dioptries ( $\frac{3}{1\text{m.}} = 3D$ ). No. 20 is *twenty* times stronger than No. 1, and is therefore  $= 20 D$ .

8. By thus following the whole numbers, a series of lenses is obtained which has for a common interval one dioptric ( $1 D$ ).

It has been found, however, that in practice we require lenses more feeble yet than those of one metre focal distance (37 Paris inches, or 39·4 English inches), and to meet this demand fractions of a dioptric have been taken: a lens of  $\frac{3}{4}$  (0·75), one of  $\frac{1}{2}$  (0·5), and one of  $\frac{1}{4}$  (0·25) of a dioptric. The quarter of a dioptric has likewise been introduced between the weak numbers of the series up to No. 2·5, and the half of a dioptric from No. 2·5 up to No. 6.

In the stronger numbers of the series, on the other hand, the interval of one dioptric is smaller than is necessary; a slight change in the distance between the lens and the eye producing here an effect greater than one dioptric. No. 19 has for this reason been suppressed.

A series of 30 lenses has therefore been settled on, as represented in column I of the table. The interval between the numbers of this series, as is seen, is 1, or  $\frac{1}{2}$ , or  $\frac{1}{4}$  of the unit. In every case the interval can be reckoned easily by a simple subtraction of two *whole* numbers. In this manner

\* According to the proposition of Nagel and Monoyer. † Monoyer.

it can with facility be calculated how much one glass is stronger than another, and how much a presbyopia or ametropia has augmented or diminished,

TABLE.

| NEW SERIES.      |                  |                                  | OLD SERIES.                     |                 |
|------------------|------------------|----------------------------------|---------------------------------|-----------------|
| I.<br>Dioptrics. | II.<br>F. in mm. | III.<br>F. in inches<br>(Paris). | IV.<br>Number.<br>F. in inches. | V.<br>F. in mm. |
| 0.25             | 4,000            | 148                              | —                               | —               |
| 0.5              | 2,000            | 74                               | 72                              | 1,944           |
|                  |                  |                                  | 60                              | 1,620           |
| 0.75             | 1,333            | 49                               | 48                              | 1,296           |
|                  |                  |                                  | 42                              | 1,134           |
| 1.               | 1,000            | 37                               | 36                              | 972             |
| 1.25             | 800              | 29.6                             | 30                              | 810             |
| 1.5              | 666              | 24.5                             | 24                              | 648             |
| 1.75             | 571              | 21                               | 20                              | 540             |
| 2.               | 500              | 18.5                             | 18                              | 486             |
| 2.25             | 444              | 16.4                             | 16                              | 432             |
| 2.5              | 405              | 15                               | 15                              | 405             |
|                  |                  |                                  | 14                              | 378             |
| 3.               | 333              | 12.3                             | 13                              | 351             |
|                  |                  |                                  | 12                              | 324             |
| 3.5              | 286              | 10.5                             | 11                              | 297             |
|                  |                  |                                  | 10                              | 270             |
| 4.               | 250              | 9.25                             | 9                               | 243             |
| 4.5              | 222              | 8.22                             | 8                               | 216             |
| 5.               | 200              | 7.4                              | 7                               | 189             |
| 5.5              | 182              | 6.74                             | 6½                              | 175             |
| 6.               | 166              | 6.14                             | 6                               | 162             |
| 7.               | 143              | 5.29                             | 5½                              | 148             |
|                  |                  |                                  | 5                               | 135             |
| 8.               | 125              | 4.6                              | 4½                              | 121             |
| 9.               | 111              | 4.11                             | 4                               | 108             |
| 10.              | 100              | 3.7                              | —                               | —               |
| 11.              | 91               | 3.37                             | 3½                              | 94              |
| 12.              | 83               | 3.07                             | 3¼                              | 87              |
| 13.              | 77               | 2.84                             | 3                               | 81              |
| 14.              | 71               | 2.63                             | 2¾                              | 74              |
| 15.              | 67               | 2.48                             | 2½                              | 67              |
| 16.              | 62               | 2.29                             | 2¼                              | 60              |
| 17.              | 59               | 2.18                             | —                               | —               |
| 18.              | 55               | 2.03                             | 2                               | 54              |
| 20.              | 50               | 1.77                             | —                               | —               |

## FOCAL DISTANCE.

9. The numbers of the glasses, it is true, do not give their focal distances, but it is an easy matter to ascertain this when

one remembers that the focal distance is the *reverse* of the refracting power. It is only necessary to invert the fraction which represents the refracting power. If we have, for example, a lens of the power of 4  $D$ , or  $\frac{4}{1\text{m.}}$ , its focal distance is  $\frac{1\text{m.}}{4}$ ,

or  $\frac{100\text{ cm.}}{4} = 25\text{ cm.}$  6  $D$  corresponds to  $\frac{100\text{ cm.}}{6} = 16\text{ cm.}$

10. The number of a lens, that is to say the number of dioptrics corresponding to a given focal distance, can be determined with the same facility. Since the dioptic is the reverse of the focal distance, the former is represented by a fraction of which the numerator is 1 m., or 100 cm., and its denominator the focal distance of the lens. If it is desired, for example, to find the dioptic ( $d$ ) corresponding to a focal length of 40 cm., we simply write  $d = \frac{1\text{ m.}}{0.4}$ , or  $\frac{100\text{ cm.}}{40} = 2.5\text{ }D$ .

In order to express this by a general formula, we call  $d$  the number of dioptrics, and  $F$ , the focal distance of the lens. We then have

$$d = \frac{1}{F} \quad \dots \quad \dots \quad \dots \quad (1)$$

$$F = \frac{1}{d} \quad \dots \quad \dots \quad \dots \quad (2)$$

or  $d \cdot F = 1$ .

#### THE PASSAGE FROM THE OLD SYSTEM TO THE NEW.

11. In order to pass from the old system to the new, we have only to remember that 1 metre = 37 inches (Paris). The dioptic ( $D$ ) corresponds, therefore, to a lens of 37 inches focal distance, and  $D$ , or  $\frac{1}{1\text{m.}}$  of the new system is equal to  $\frac{1}{37}$  of the old. Two dioptrics ( $2\text{ }D$ ) =  $\frac{2}{37}$ , or  $\frac{1}{18.5}$ , No. 18.5 of the old system.

3  $D$  =  $\frac{3}{37} = \frac{1}{12.3}$ , No. 12 of the old system.

4  $D$  =  $\frac{4}{37} = \frac{1}{9.25}$ , " 9 " "

$d\text{ }D$  =  $\frac{n}{37} = \text{No. } \frac{37}{n}$  of the old system.

12. We proceed in an inverse manner when we wish to find the dioptric corresponding to a given number of the old system; that is to say, we divide 37 by the number of the glass. Example:—We have No. 17 of the old system. The number of times  $\frac{1}{37}$  is contained in 17 gives us the value of No. 17 in the new system. Now, to divide 17 by  $\frac{1}{37}$  is equivalent to dividing 37 by 17, and we have as a result  $\frac{37}{17} = 2.25 D.$

13. In order to express this in a general manner, we call the number of the old system (the number of inches)  $a$ , the number of the new system (number of dioptries)  $d$ , and obtain the following equations:—

$$\frac{d}{37} = \frac{1}{a} \quad \dots \dots \dots (3)$$

$$d = \frac{37}{a} \quad \dots \dots \dots (4)$$

$$a \cdot d = 37$$

*The Metrical System in the Determination of Refraction  
and Accommodation.*

I. REFRACTION.

14. Let us first state some general and well recognised points:—

(a). The *punctum remotum* of the eye, and its image on the retina, are conjugate foci, the eye being in a state of rest; the distance of the *punctum remotum* from the eye ( $R$ ) and the length of the eye are consequently conjugate focal distances in a state of repose.

(b). The *punctum proximum* and its image on the retina are the conjugate foci of the eye in a state of maximum accommodation. The distance from the *punctum proximum* to the eye ( $P$ ), and the length of the eye, are conjugate focal distances, corresponding to the maximum of accommodation.

(c). To correct an *ametropic eye*, is to adapt it to parallel rays, or better, to give to parallel rays a direction as if they came from the *punctum remotum* of that eye.

15. Formerly we determined the first conjugate focal

distance ( $R$ ) of the eye in a state of rest, which, expressed in inches, gave the number of the correcting glass, and inversely the number of the correcting glass was equal to the first conjugate focal distance of the eye; because in order to give parallel rays a direction as if they came from the *punctum remotum*, the focus of that lens must coincide with the *punctum remotum*.

It was for this reason that in determining *myopia* it sufficed to let the individual read at the greatest distance ( $R$ ) he was able (*punctum remotum*), and that distance, expressed in inches, gave directly the number of the correcting glass. If this distance was six inches, he required a correcting glass No. 6. *Myopia* was equal to one-sixth.

In *hypermetropia*, on the other hand, the *punctum remotum* is situated *behind* the eye, and the focal distance being negative, could not be determined directly. But the number of the convex lens which corrected the hypermetropia gave, for the reasons just stated, the focal length of the eye. Thus, the *punctum remotum* of a hypermetropic eye of  $\frac{1}{36}$  is situated 36 inches behind the eye.

In calling  $R$  the distance between the *punctum remotum* and the eye, we had for *ametropia* the formula  $\frac{1}{R}$ , which represented at the same time the refracting power of the correcting lens,  $R$  being its focal distance. This lens was convex or concave according as the focal distance of the eye was negative ( $H$ .) or positive ( $M$ .).

16. According to the metrical system, we do essentially the same thing, though we view it from another stand-point, and in the following manner:—

An *emmetropic* eye is characterised by the fact that the retina is situated just at the focus of parallel rays.

An *ametropic* eye is an eye whose retina is not situated in the focus of the dioptric system, but in *front of* or *behind* it.

Ametropia, then, consists in a *deficiency* or *excess* of the refracting power of the dioptric system, relative to the length of the eye, and it finds its expression in the number of dioptries ( $r$ )



which it is necessary to add to or subtract from the eye in order to unite parallel rays on the retina, or, which is the same thing, in order to render an ametropic eye emmetropic.

Thus, while we formerly found the conjugate focal distance of the ametropic eye we now determine its *relative deficiency or excess of refracting power*, and this we express in dioptries.

Thus, *hypermetropia* consists in a *relative deficiency of refraction*, and its degree is represented by the number of dioptries ( $r$ ) which it is necessary to add to the eye in order to adapt it to parallel rays coming from infinity, or to render it emmetropic. An eye has a hypermetropia of  $6 D$  when it is  $6 D$  more feeble in its refraction than an emmetropic eye, or when it requires a convex No. 6 in order that it may see at infinity. An eye has an  $H = r$  when it requires  $r$  dioptries in order to enable it to see at infinity.

The focal distance of the correcting lens is still equal to the distance  $R$  between the *punctum remotum* and the eye ( $\frac{1}{R} = r$ ), but being no longer expressed by the No. of the glass, it is necessary to calculate it according to the formula already given (2). Thus, the *punctum remotum* of a hypermetropic eye corrected by  $+6 D$  placed close to the cornea, is situated  $\frac{100 \text{ cm.}}{6} = 16.5 \text{ cm.}$  behind the eye.

The reverse of this is found in *myopia*. Here there is a *relative excess* of refracting power, and the degree of the myopia therefore finds its expression in the number of dioptries ( $r$ ) by which it is necessary to *diminish* this refracting power in order to adapt the eye to infinity. The lens must be negative (concave), and its refracting power (No. of  $D$ ) must be equal to the excess of refraction of the eye ( $r$ ).

An eye which has need of a concave glass of  $8 D$  will have  $M = 8$ .

Nothing prevents us, however, from determining the degree of myopia directly by the aid of the distance  $R$  of the

*punctum remotum*, as was formerly done. This distance, expressed in centimetres, it is true, does not give the No. of  $D$ , but simply the focal distance of the correcting lens ( $r$ ). In order, however, to find the No. of  $D$ , it is only necessary to make a simple calculation according to formula (1)  $d = \frac{1}{F}$ .

Thus, a myope who reads up to the distance of 40 cm., will have  $M = \frac{1\text{m.}}{40\text{cm.}} = 2.5 D$ .

## II.—ACCOMMODATION.

17. The accommodation is the change which takes place in the eye when it adapts itself from vision at a distance to vision at a near point. This is affected, as is now generally acknowledged, by an increase in the refracting power of the dioptric system. Nothing is more natural than that this increase in refraction should find its expression by the corresponding number of dioptries (*units of refraction*).

In a state of *rest*, the eye is adapted for its *punctum remotum*; in a state of *maximum accommodation*, for its *punctum proximum*.

The *amount* of accommodation of which the eye is capable—the *amplitude* of accommodation of *Donders*—is therefore represented by the convex lens which adapts the eye deprived of its accommodation to vision at its *punctum proximum*.

### AMPLITUDE OF ACCOMMODATION IN EMMETROPIA.

18. The *amplitude of accommodation* of an eye which, in a state of rest, is adapted for infinity ( $R = \infty$ ), is represented by a lens the focal distance of which is equal to the distance ( $P$ ) between the *punctum proximum* and the eye; because in order to enable an eye adapted for infinity to see at the distance of its *punctum proximum*, the rays proceeding from this point must be rendered parallel. This can take place only when the focus of the lens coincides with the *punctum proximum*. According to the formula of Donders—

$$\frac{1}{A} = \frac{1}{P},$$

where  $\frac{1}{A}$  = the amplitude of accommodation, and  $P$  = the distance between the *punctum proximum* and the eye; therefore  $\frac{1}{P}$  = the lens of the same focal distance.

We express this lens in the metrical system by the number of dioptries,  $p$ , which it represents. We have therefore  $\frac{1}{P} = p$ , and  $P = \frac{1}{p}$ . The formula for the amplitude of accommodation then becomes—

$$a = p \quad \dots \quad (6)$$

The amplitude of accommodation of an emmetropic eye which sees up to a distance of 20 cm., is therefore represented by a convex lens of  $\frac{100 \text{ cm.}}{20} = 5 D$ . An emmetropic eye which possesses an amplitude of accommodation of 6  $D$  has its *punctum proximum* at  $\frac{100 \text{ cm.}}{5} = 16 \text{ cm.}$

#### AMPLITUDE OF ACCOMMODATION IN THE HYPERMETROPIC EYE.

19. If the eye has already need of its accommodation to enable it to see at infinity—to render it emmetropic—as is the case in a *hypermetropic* eye, then evidently it is necessary to add this effort to that which changes the adaptation from infinity to the *punctum proximum*. Now the lens which changes the hypermetropic eye to an emmetropic eye, is  $= r$ , and is the correcting lens of the hypermetropia, and we obtain therefore for the amplitude of accommodation of the hypermetropic eye the formula—

$$a = p + r \quad \dots \quad (7)$$

that which corresponds to the old formula—

$$\frac{1}{A} = \frac{1}{P} + \frac{1}{R},$$

where  $P$  and  $R$  have the values mentioned above.

Thus a hypermetrope of 3  $D$  who sees up to 16 cm. (6  $D$ ), has an amplitude of accommodation of—

$$a = 6 + 3 = 9 D.$$

Inversely, an individual who has  $H = 2 D$ , and has an

amplitude of accommodation = 7  $D$ , has his *punctum proximum*, where?—

$$p = a - r \text{ (from formula, 7)}$$

$$p = 7 - 2 = 5 \text{ } D;$$

$$\text{therefore } P = \frac{100 \text{ cm.}}{5} = 20 \text{ cm.}$$

#### AMPLITUDE OF ACCOMMODATION IN THE MYOPIC EYE.

20. The amplitude of accommodation in a *myope* who sees up to a given distance, is necessarily less than that of an emmetrope who sees at the same distance, because already in a state of rest, the myopic eye is adapted to a distance for which the emmetropic eye has need of accommodation. It is necessary, therefore, to *subtract* the power of refraction by which the myopic eye surpasses the emmetropic from the quantity ( $p$ ) which represents the refraction at the *punctum proximum*. Now we know the first is equal to  $r$ , and we obtain for myopia the formula—

$$a = p - r \quad \dots \quad (8);$$

according to the old system it was—

$$\frac{1}{A} = \frac{1}{P} - \frac{1}{R}.$$

A myope of 12  $D$ , who sees up to 6 cm.

( $\frac{100 \text{ cm.}}{6} = 16 \text{ } D$ ), has an amplitude of accommodation—

$$a = 16 - 12 = 4 \text{ } D.$$

And a myope of 4.5  $D$ , who has 5.5  $D$  amplitude of accommodation, will have his *punctum proximum* at 10 cm., since  $p = a + r = 5.5 + 4.5 = 10 \text{ } D$ , which corresponds to  $\frac{100}{10} = 10 \text{ cm.}$

#### INFLUENCE OF AGE ON THE AMPLITUDE OF ACCOMMODATION.

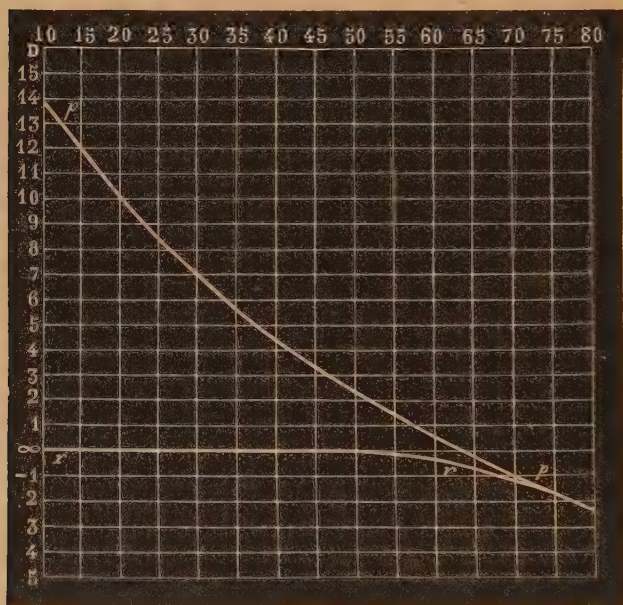
21. It is known that from the tenth year onward the eye gradually loses its power of accommodation.

*Donders*, who discovered this fact and established the rate of its progress, has given a diagram which represents the march of the *punctum proximum*, and also that of the

*punctum remotum*, and thus the *amplitude of the accommodation* at the various periods of life.

Later researches, however, have caused the great physiologist of Utrecht to modify this diagram, and to give it a form of which he spoke at the last Ophthalmological Congress at Hiedelberg.\* This corrected diagram our illustrious Master has kindly permitted us to publish.†

Fig. 1.



The figures at the top of the diagram indicate the ages, with a common interval of five years. Those on the left correspond to the dioptries. The curve  $r$  corresponds to the refraction of the eye in a state of repose. This remains, as it is seen, unchanged up to the fiftieth year. From this

\* Zehenders, Monatsbl. xiii, p. 474.

† The former diagram of Donders gave the distance  $R$  and  $P$  in inches, the new diagram gives  $r$  and  $p$ , that is to say, the corresponding numbers of dioptries.



time on the refractive power diminishes. The emmetropic eye, in which  $r = \infty$ , becomes, after this time, hypermetropic, the hypermetropic eye becomes more hypermetropic, and the myopic eye becomes either less myopic, or emmetropic, or even hypermetropic, according to the degree of its myopia. The curve  $pp$  gives the refraction of the eye in the state of its *maximum accommodation*. This diminishes from the tenth year on, and becomes after the sixty-fifth year, even less than the refraction was before in a state of repose. Nevertheless, there yet remains some power of accommodation, so long as the two curves  $rr$  and  $pp$  do not meet. This meeting takes place, however, at the seventy-fifth year, and after that time no accommodation power is left.

22. The *amplitude of accommodation* at any age is represented by the number of dioptrics comprised between  $pp$  and  $rr$  on the vertical line which corresponds to that age.

We obtain for the amplitude of accommodation at the various ages the following series :—

| Age. |       |    |    | Amplitude of<br>Accommodation. |             |
|------|-------|----|----|--------------------------------|-------------|
|      |       |    |    | (a)                            |             |
| 10   | Years | .. | .. | ..                             | 14 <i>D</i> |
| 15   | "     | .. | .  | ..                             | 12 "        |
| 20   | "     | .. | .. | ..                             | 10 "        |
| 25   | "     | .. | .. | ..                             | 8.5 "       |
| 30   | "     | .. | .. | ..                             | 7 "         |
| 35   | "     | .. | .. | ..                             | 5.5 "       |
| 40   | "     | .. | .. | ..                             | 4.5 "       |
| 45   | "     | .. | .. | ..                             | 3.5 "       |
| 50   | "     | .. | .. | ..                             | 2.5 "       |
| 55   | "     | .. | .. | ..                             | 1.75 "      |
| 60   | "     | .. | .. | ..                             | 1 "         |
| 65   | "     | .. | .. | ..                             | 0.75 "      |
| 70   | "     | .. | .. | ..                             | 0.25 "      |
| 75   | "     | .. | .. | ..                             | 0 "         |

The diagram of Donders represents the emmetropic eye in which  $r = \infty$ . It holds good, however, for the ametropic

eye. It is only necessary to introduce, instead of infinity, the numbers of dioptrics ( $r$ ) corresponding to the ametropia, and to add them to, or subtract them from, the other numbers according as  $r$  is negative or positive. ( $H$ . or  $M$ .)

The amplitude of accommodation remains the same in ametropia as in emmetropia, and the figures in the above series remain unchanged in all cases. It is only the position of the *punctum proximum* which changes, the relation between the *punctum proximum* and *punctum remotum* remaining the same as in emmetropia.

The distance  $P$  from the *punctum proximum* is equal to the focal distance  $p$ , as obtained in the manner indicated above. The amplitude of accommodation for  $E$ ,  $H$ , and  $M$ , can also be calculated by means of formulas 6, 7, and 8.

23. *Presbyopia*.—That state of the eye is called *presbyopia* where the *punctum proximum* has receded beyond eight inches. Now 8 inches = 216 mm., or 22 cm. (nearly), and therefore is represented by 4.5  $D$ .

According to the new system, we consider that *presbyopia* commences at that age when the eye can no longer see within the distance of 22 cm., and it finds its expression in the number of  $D$  which it is necessary to give the eye in order to bring its *punctum proximum* again up to that distance, that is to say, in order to give it a *refracting power* of 4.5  $D$ .\*

A glance at the diagram of Donders shows us that this occurs at the *age of forty years*, at which time the *emmetropic* eye does not possess more than 4.5  $D$ . It is at this age therefore that the *presbyopia* of the *emmetropic* eye begins, and the amount of *presbyopia* for any age is equal to the difference between the dioptrics which represent the vision at near distances (the curve  $pp$ ) and 4.5  $D$ . This result will be at the

\* The distance of 22 cm. may appear too small, since we rarely use the eyes at so short a distance. But the lens which, combined with the maximum effort of accommodation, brings the *punctum proximum* up to 22 cm., allows the individual to work at a greater distance when the accommodation becomes fatigued.

same time the number of the glass which it will be necessary to give the emmetrope in order to correct his presbyopia.

For the presbyopia of the emmetropic eye at its various ages we have the following table:—

| Age. | <i>p.</i> | Presbyopia.    | <i>D.</i> |
|------|-----------|----------------|-----------|
| 40   | 4·5       | 4·5 — 4·5 = 0· |           |
| 45   | 3·5       | 4·5 — 3·5 = 1· |           |
| 50   | 2·5       | 4·5 — 2·5 = 2· |           |
| 55   | 1·5       | 4·5 — 1·5 = 3· |           |
| 60   | 0·5       | 4·5 — 0·5 = 4· |           |
| 65   | 0·        | 4·5 — 0· = 4·5 |           |
| 70   | — 1·      | 4·5 + 1· = 5·5 |           |
| 75   | — 1·5     | 4·5 + 1·5 = 6· |           |
| 80   | — 2·5     | 4·5 + 2·5 = 7· |           |

We see that from being 0· at the age of 40 years, the presbyopia increases by one dioptric every 5 years up to the age of 60. From this time it increases sometimes by one and sometimes by one-half of a dioptric for the same time.

Example: An emmetrope of 55 years complains that he cannot any longer read continuously. He has now passed, by fifteen years, the time when presbyopia sets in, that is  $3 \times 5$ ; and since it requires 1 *D* for every five years, No. 3 *D* will be necessary to correct his presbyopia.

An emmetrope of 47 years asks for spectacles. He is seven years beyond 40, and for him  $\frac{7}{5} =$  about 1·5 *D*, are necessary.

An emmetrope of 75 years complains of the insufficiency of his glasses. His presbyopia is = 6 *D*. But if we give him 1 *D* for every five years since 40, that is No. 7, he will be entirely satisfied.

24. In *ametropia* the presbyopia is calculated in the same manner, after the ametropia has been corrected.

#### PRESBYOPIA OF HYPERMETROPIA.

The number of *D* which is necessary to correct the *hypermetropia*, evidently must be *added* to those which correct the presbyopia of an emmetropic eye of the same age.

Example: What No. of glasses ought to be given to a hypermetrope of  $2 D$  at the age of 60 years? If he were emmetropic he would require No. 4, since he is  $4 \times 5$  years past the age at which presbyopia commences. But he had already need of  $2 D$  to render him emmetropic, and it will therefore be necessary to give him  $4 + 2 = 6 D$ , for work at near distances.

#### PRESBYOPIA OF MYOPIA.

25. For *myopia* we proceed in an inverse manner. It requires a concave lens to render a myopic eye emmetropic, and this concave lens which corrects the myopia and the convex lens which corrects the presbyopia neutralize each other in part. For this reason we must give to the myope who has become presbyopic only the glass which results from the subtraction of the two lenses.

Example: A myope of  $3 D$  asks for glasses at the age of 65 years. Were he emmetropic he would require  $+4.5 D$ , but as he has  $M = .3 D$ , he only has need of  $4.5 - 3 = +1.5 D$ .

What glasses must we give to an individual of  $52\frac{1}{2}$  years who has  $M = 10 D$ , in order to correct his presbyopia? An emmetrope at  $52\frac{1}{2}$  years needs  $(52\frac{1}{2} - 40 = 12\frac{1}{2} = 2.5 \times 5)$   $2.5 D$ . In combining therefore the No. 2.5 convex with No. 10 concave, which corrects the myopia, we have  $2.5 - 10 = -7.5 D$ . It will be necessary then to give a negative glass of  $7.5 D$  in order to bring the *punctum proximum* up to 22 cm.

26. There is no need to multiply examples. We have given sufficient, we trust, to explain the operation of the new system in questions so important in daily practice, and to show how simple and easy it is to make the calculations in the head. For we should not forget that in all the examples we have given it would have been impossible to make the calculations without the aid of paper and pencil, since in

place of whole numbers we should have had to do with fractions.

But if the practical ophthalmologist draws great advantage from the introduction of the metrical system and its simplifications, the advantages which accrue to physiological optics are not less important.

Let us recall to mind for a moment that the measurements of the eye, the radii of its surfaces, the optical constants, &c., are all expressed in millimetres.

And this is the measure which is best adapted for this purpose, as the

#### REDUCED EYE OF DONDERS

shows.

27. This eye, as is well known, represents the properties of the human eye, but simplifies all calculations connected with it in an extraordinary manner.

This reduced eye has only a single refracting surface, with a radius of curvature of 5 mm. filled with water with an index of refraction  $= \frac{4}{3}$ . Its length is 20 mm. in a state of emmetropia, a distance which represents at the same time its second focal distance ( $F''$ ), (the refracting power of the eye is therefore  $\frac{1.00}{0.2} = 50 D$ ). Its first focal distance ( $F'$ ) is 15 mm. In order to find rapidly the shortening of a *hypermetropic* eye, or the lengthening of a *myopic* eye, Donders has given the simple formula—

$$\eta = \frac{F' \cdot F''}{F}$$

where  $\eta$  = the difference between the length of the emmetropic and ametropic eye,  $F'$  and  $F''$  the focal distances mentioned above (therefore  $F' \cdot F'' = 15 \cdot 20 = 300$  mm.), and  $F$  = the focal distance of the lens which, placed in the anterior focal point of the eye (13 mm. in front of the cornea of the natural eye), where glasses are usually placed, corrects the ametropia.

What now is more simple than to calculate in the head



the length of an *ametropic* eye? We have only to divide 300 by the focal distance, expressed in mm., of the correcting lens, and to *subtract* the resulting number from the length of the *emmetropic* eye, for *hypermetropia*, and *add* it for *myopia*. If it is desired, for instance, to know the length of a hypermetropic eye corrected by 5 *D*, we have only to divide the focal distance of 5 *D* = 200 mm. by the focal distance  $F = 300$  mm., in order to obtain  $\eta = \frac{200}{300} = 1.5$  mm. This eye will then have a length 1.5 mm. less than that of the emmetropic eye.

For a *myopic* eye corrected by  $-12$  *D*, we obtain  $F = \frac{1\text{ m}}{12} = 80$  mm., therefore  $\eta = \frac{300}{80} = 3.7$  mm. The myopic eye of 12 dioptrics will have then a length 3.7 mm. greater than that of the emmetropic eye.

For these fundamental calculations, for the solution of so many important problems, such as the influence of correcting glasses on the acuity of vision, the amplification of the ophthalmoscopic images, the difference between the ametropia resulting from a default of refraction (*ametropia courbure*), and the ametropia resulting from a default in the length of the eye (*ametropia axile*), &c., the calculations were much more complicated by the old system, which expressed in inches the lenses, as well as the degree of ametropia.

We have only to call to mind that one inch (Paris) = 27.0699 mm., in order to see how far from simple the reductions must be.

#### THE ARTIFICIAL EYE OF LANDOLT.

28. Following the principles given by Donders in the construction of his reduced eye, we have also made an artificial eye, designed for ophthalmological demonstration and the experimental control of physiological calculations, but especially for the solution of all the problems relating to the size of the retinal images, the influence of correcting glasses, &c., *without the necessity of calculation*.

This artificial eye has one refracting surface, of 5 mm. radius of curvature. It is filled with water ( $\frac{4}{3}$  index of



Fig. 2.

refraction), and can be lengthened or shortened so as to have every desired degree of refraction. The retina is represented

by a polished glass which is graduated in half millimetres. On this it is easy to observe and appreciate exactly the size of the retinal images in all the different conditions of the eye.

In order to study the influence of the correcting glasses on the acuity of vision, that is to say, on the size of the retinal images, there is a frame movable on a horizontal stem, also graduated, in which to place the correcting glasses, and which can be removed from or approached to the eye, at will.

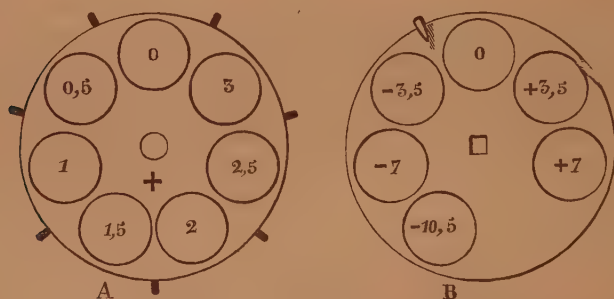


Fig. 3.

One or more small convex lenses, which can be introduced into the eye, permit a comparison between the retinal images in a state of accommodation at a definite distance, with those of the eye in a state of repose, but adapted to the same distance by means of a convex lens placed in front of it. Our artificial eye serves equally well for ophthalmoscopic examinations. For this purpose one has only to place at the fundus of the eye an opaque plate on which is painted a representation of the fundus of the natural eye.

The advantages of this eye over the others that have been constructed up to this time are apparent. It represents actually the conditions of the living eye, since the rays of light pursue their way in the second medium up to the retina, and do not traverse only a convex lens placed in the air.

For this reason the images which we observe in the fundus of the artificial eye have the same magnitude as those

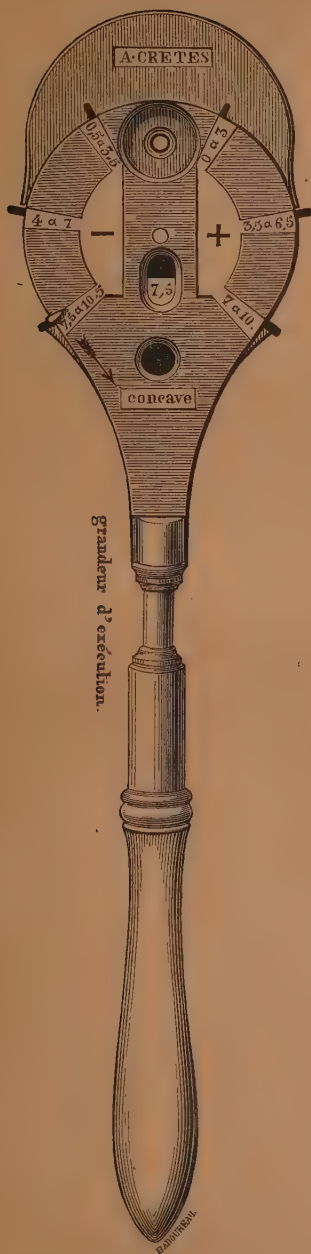


Fig. 4.

which the same objects produce on our own eyes; and for the same reason the ophthalmoscopic image of the artificial eye presents the same enlargements as the fundus of the human eye. This eye was exhibited at the Kensington Exposition, and is made by Nachet, Rue St. Severin, Paris.

#### THE REFRACTION OPHTHALMOSCOPE OF LANDOLT.

29. The facility with which the lenses of the new system can be combined has already begun to bear its fruit. We instance the *ophthalmoscope metrique* of Dr. Wecker, which was presented at the Heidelberg Congress in 1875 ("Zehender's Monats. bl." xiii, p. 458).

Profiting by these same advantages, we also have constructed a refraction ophthalmoscope. It consists of two discs of Rekoss, of the size given in Fig. 3, which are superposed the one on the other behind the ophthalmoscopic mirror, and revolve about the same centre.

The disc *A* contains six metrical lenses, Nos. 0, +0.5, +1, +1.5, +2, +2.5, and +3.

The disc *B* contains Nos. 0, +3.5, +7, and -3.5, -7, and -10.5.

In placing the free aperture of the disc *B* behind the opening in the mirror, and making the disc *A* revolve, we obtain, first 0, and afterwards in succession the following series of *convex* lenses:—

0·5

1·

1·5

2·

2·5

3·

When the disc *A* has completed its turn, we place No. +3·5 of *B* behind the aperture in the mirror, and by turning *A* for a *second* time we obtain the following second series of *convex* lenses:—

$$3·5 + 0· = 3·5$$

$$3·5 + 0·5 = 4·$$

$$3·5 + 1· = 4·5$$

$$3·5 + 1·5 = 5·$$

$$3·5 + 2· = 5·5$$

$$3·5 + 2·5 = 6·$$

$$3·6 + 3· = 6·5$$

We now push the No. + 7 of the disc *B* behind the aperture, and the combinations with *A* give:—

$$7 + 0· = 7·$$

$$7 + 0·5 = 7·5$$

$$7 + 1· = 8·$$

$$7 + 1·5 = 8·5$$

$$7 + 2· = 9·$$

$$7 + 2·5 = 9·5$$

$$7 + 3· = 10·$$

We have by this means obtained, besides the free aperture, a series of 20 convex glasses, with an interval of one half a dioptric, from No. 0·5 to No. 10; corresponding to Nos. 74 and 3·7 of the old system.



Let us now place behind the free aperture No.—3·5 of the disc *B*. By turning *A* in the *backward* direction we obtain:—

$$\begin{aligned}
 - 3\cdot5 + 3\cdot &= - 0\cdot5 \\
 - 3\cdot5 + 2\cdot5 &= - 1\cdot \\
 - 3\cdot5 + 2\cdot &= - 1\cdot5 \\
 - 3\cdot5 + 1\cdot5 &= - 2\cdot \\
 - 3\cdot5 + 1\cdot &= - 2\cdot5 \\
 - 3\cdot5 + 0\cdot5 &= - 3\cdot \\
 - 3\cdot5 + 0\cdot &= - 3\cdot5
 \end{aligned}$$

If then the No. — 7 of *B* is brought behind the free aperture, and we again turn *A*, we have:—

$$\begin{aligned}
 - 7 + 3\cdot &= - 4\cdot \\
 - 7 + 2\cdot5 &= - 4\cdot5 \\
 - 7 + 2\cdot &= - 5\cdot \\
 - 7 + 1\cdot5 &= - 5\cdot5 \\
 - 7 + 1\cdot &= - 6\cdot \\
 - 7 + 0\cdot5 &= - 6\cdot5 \\
 - 7 + 0\cdot &= - 7\cdot
 \end{aligned}$$

Finally, if — 10·5 of the disc *B* is combined with the lenses of *A*, the following series of concave glasses is obtained:—

$$\begin{aligned}
 - 10\cdot5 + 3\cdot &= - 7\cdot5 \\
 - 10\cdot5 + 2\cdot5 &= - 8\cdot \\
 - 10\cdot5 + 2\cdot &= - 8\cdot5 \\
 - 10\cdot5 + 1\cdot5 &= - 9\cdot \\
 - 10\cdot5 + 1\cdot &= - 9\cdot5 \\
 - 10\cdot5 + 0\cdot5 &= - 10\cdot \\
 - 10\cdot5 + 0\cdot &= - 10\cdot5
 \end{aligned}$$

We have thus 21 numbers of *concave* lenses, with a common interval of a half dioptric, and reaching to No.—10·5, which is the equivalent of No.  $3\frac{1}{2}$  of the old system.

Our ophthalmoscope therefore furnishes us with 42 different numbers of *D*, including 0, without the necessity of changing the discs, as is the case in the ophthalmoscope of

LORING, and without having the small lenses or large discs of other refraction ophthalmoscopes.

On the contrary, we have chosen much larger glasses than those generally found in the refraction ophthalmoscopes. Their diameter is 9 mm. This not only permits them to be cleaned with ease, but especially allows them to be used as an instrument for the *subjective* determination of refraction. By simply removing the mirror the instrument becomes in the hand of the patient a *lorgnette*, with which he determines the number of the spectacles he requires quite as well as by the aid of the glasses in our trial boxes.

A mechanism attached to the instrument shows the numbers which result from the combinations of the various lenses.

The numbers from 0 to 10 convexes, and from 0 to 10·5 concaves are amply sufficient for the objective determination of refraction by the aid of the ophthalmoscope. Occasionally, however, it may be necessary to have still stronger numbers for the *subjective* determination. To fulfil this purpose we have added to our instrument a No. 10 concave of the same size as the mirror. This lens is introduced in the place of the mirror, and by turning the concave discs we obtain a new series of numbers which can be easily calculated by adding 10 to the number read off on the instrument. In this manner we obtain a series extending up to  $-20\cdot5$  — ( $1\frac{1}{2}$  of the old series).

To obtain a series of convex glasses, we use those lenses which are employed in the examination by the inverted image. For this end we take Nos. +10 and +20, and introducing them separately in the place of the mirror cause the convex lenses to revolve. We can thus obtain lenses sufficiently strong for the correction of aphakia.

In this manner, as is seen, we largely increase the number of lenses obtainable by our instrument.

For the determination of Astigmatism, we introduce in place of the mirror a disc with a stenopaic slit. This disc turns around its centre (the aperture of the instrument), and

a graduation marked on the side of the instrument, not seen in the figure, indicates the degree of inclination of the slit.

The lenses are plano-spherical, and are applied to each other by their plane surfaces.

In order to diminish the number of glasses through which it is necessary to look, the ophthalmoscope mirror is perforated.

The instrument is made by Mons. Crétés, 66, Rue de Rennes, Paris.

#### PHAKOMETER OF DR. SNELLEN.

30. In comparing the columns of focal distances of the lenses of the metrical system with those of the old system (columns III and IV of the table), it will be seen that only a very small number of the old coincide with those of the new system. On this account the manufacturers of lenses will have to change almost completely the forms which they employ in the manufacture of lenses. This change, however, will be made in course of time.

It is important, however, to be able to verify oneself the lenses which are furnished us during the time of this transition. For this purpose an instrument, from the fertile and ingenious brain of Dr. Snellen, of Utrecht, and designed for the determination of the foci of lenses comes most *à propos*.

This instrument, to which the inventor has given the name of *Phakometer*, is based on the principle that *when an object and the image of it which a convex lens furnishes have the same size, the object and the image are at equal distances from the lens, and, moreover, that this distance is double the focal distance of the lens.*

The lens to be measured is fixed in the centre of the apparatus, while the object (luminous points) and the ground glass on which the image is formed are moved through equal distances, but in a contrary direction, by means of two springs at the end of which they are fixed.

The glass which receives the image is moved along a

scale, on the margins of which are marked the numbers of the dioptries corresponding to each distance.

The instrument is exact to one-twentieth of a dioptric.

Since the image is always of the same size as the object, the adjustment of the instrument is extremely easy.

If the image furnished by the lens coincides exactly with points marked on the glass, then the centre of the lens coincides with the axis of the instrument. Thus it serves at the same time for the determination of the *centring* of glasses.

For *concave* lenses the determination can only be made by comparing them with convex lenses of a known strength.

The Phakometer is made by D. B. Kagenaar, Utrecht, price 37.50 florins.

*Error in Mr. Hutchinson's Paper on the Prognosis in Tobacco  
Amaurosis.*

Case 21 refers to the same patient as Case 41 in the Tables.  
The case entered as No. 41 contains the most recent and  
accurate notes.



## PROFESSOR DONDERS' LECTURE AT MOORFIELDS.

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On Tuesday afternoon, May 30th, Professor Donders gave a lecture at the Moorfields Hospital on the Metrical System in its application to Ophthalmology. Many of the more important points explained by the lecturer are given also in the article on the same subject by Dr. Landolt, a translation of which we have the pleasure of publishing in this number, and we need not therefore for the present report it fully.

During the lecture, Snellen's Phacometer was shown and explained, and after the lecture Professor Donders demonstrated its accuracy to many of the audience.

Rouleau's case of trial lenses, ground from metrical measurements and numbered by dioptics, was also shown.

The audience comprised most of the leading Ophthalmic Surgeons of London.

The following Course of Clinical Lectures has lately been given by Mr. HUTCHINSON, at the Hospital.

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*The Lectures begin at 8 p.m. The Demonstration of Cases commences at 7.30.*

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LECT. I.—Syphilitic Iritis. (January 13th, 1876.)

II.—Syphilitic Choroiditis. (January 20th.)

III.—Heredito-Syphilitic Choroiditis. (January 27th.)

IV.—Choroiditis from other causes than Syphilis, or of doubtful diagnosis. (February 3rd.)

V.—Syphilitic Retinitis. (February 10th.)

VI.—Cases of Hyalitis, and on Hyalitis as a symptom and a complication. (February 17th.)

VII.—Optic Neuritis in connexion with Syphilis. (February 24th.)

VIII.—On the Prognosis in cases of Tobacco Amaurosis. (March 2nd.)

IX.—On cases in women resembling the Tobacco Amaurosis of men, and on similar cases in men who have not smoked. (March 9th.)

X.—On a group of remarkable cases of recovery after prolonged blindness with nerve-pallor. (March 16th.)

XI.—Sympathetic or Reflex Ophthalmitis. (March 23rd.)

XII.—On disturbance of the nutrition and circulation in the Eye, produced through nerve influence. (March 30th.)

XIII.—On the influence of dental and other forms of Neuralgia on the Eye. (April 6th.)

XIV.—The influence of disorders of the sexual functions on the nutrition of the Eyeball. (April 13th.)

XV.—On a group of cases in which many of the muscles of both Eyeballs are paralysed simultaneously. (April 20th.)



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